US009439009B2

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Kim et al.

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(54) **METHOD OF FITTING HEARING AID CONNECTED TO MOBILE TERMINAL AND MOBILE TERMINAL PERFORMING THE METHOD**

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)

(72) Inventors: **Yu-na Kim**, Suwon-si (KR); **Yang-wook Kim**, Hwaseong-si (KR); **Ik-Soo Kim**, Seoul (KR)

(73) Assignee: **SAMSUNG ELECTRONICS CO., LTD.**, Suwon-si (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) Filed: **Nov. 20, 2013**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
H04R 25/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H04R 25/70*** (2013.01)

(58) **Field of Classification Search**
CPC H04M 1/2475; H04M 1/6066; H04M 1/7253; H04R 2225/41; H04R 2225/55; H04R 2460/07; H04R 1/1016; H04R 5/033; H04R 5/04; H04R 2201/107; H04R 2410/05; H04R 2499/11; H04R 25/02; H04R 3/005; H04R 2225/025; H04R 2410/01; H04R 2430/01; H04R 25/48; H04R 25/505; H04R 25/558; G10K 2210/01
USPC 381/314–315, 74, 328, 71.6, 309, 311, 381/317, 71.1, 23.1, 370, 94.1; 455/570
See application file for complete search history.

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Primary Examiner — Paul S Kim
Assistant Examiner — Norman Yu
(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

A method of fitting a hearing aid connected to a mobile terminal is provided. The method may include acquiring location information of a location of the mobile terminal, transmitting the location information to a server, receiving, from the server, information about at least one recommended fitting parameter model adapted to hearing conditions of the location and hearing characteristics of a user of the hearing aid, and displaying the information about the at least one recommended fitting parameter model. The method may also include receiving a fitting parameter model selected by the user from among the at least one recommended fitting parameter model, and controlling the hearing aid to function according to the received fitting parameter model.

38 Claims, 22 Drawing Sheets

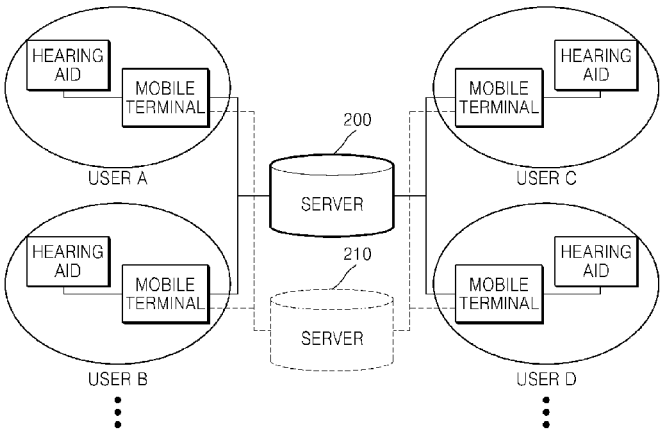

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FIG. 1

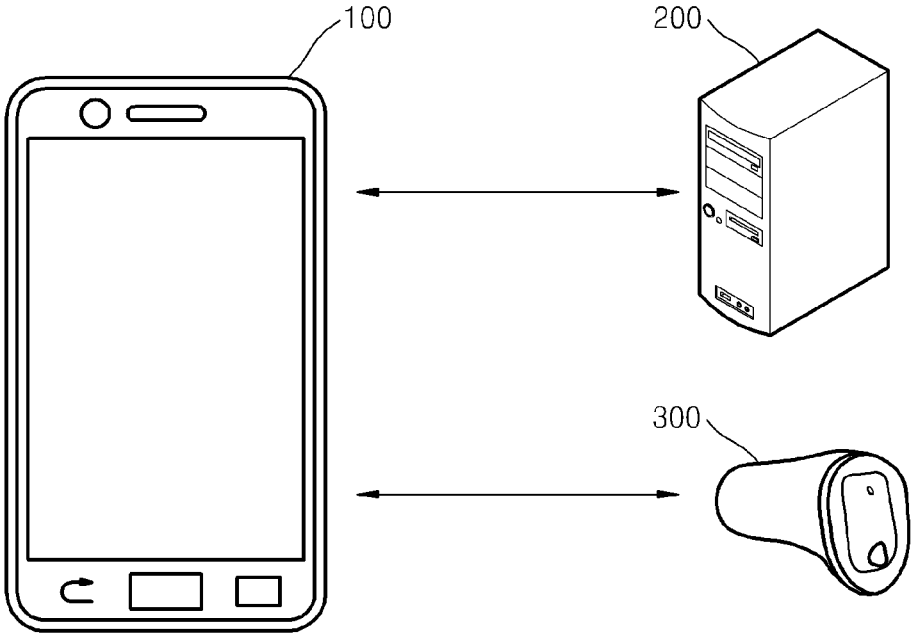


FIG. 2

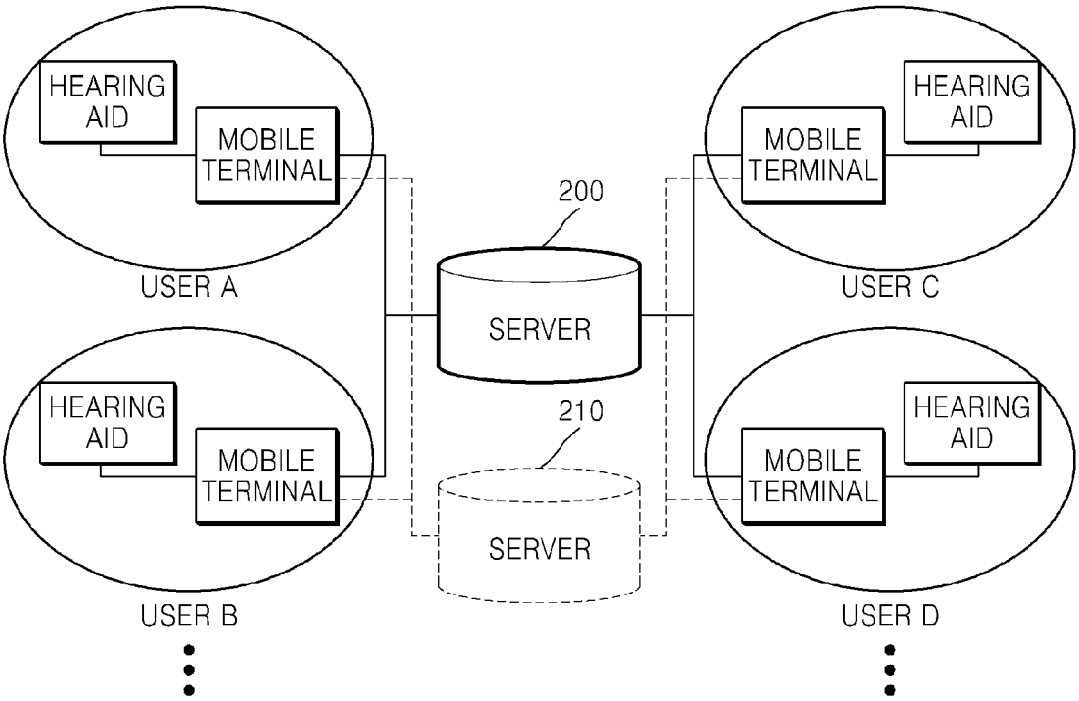

HEARING AID
MOBILE TERMINAL
USER A
200
SERVER
HEARING AID
MOBILE TERMINAL
USER C
HEARING AID
MOBILE TERMINAL
USER B
210
SERVER
HEARING AID
MOBILE TERMINAL
USER D

FIG. 3

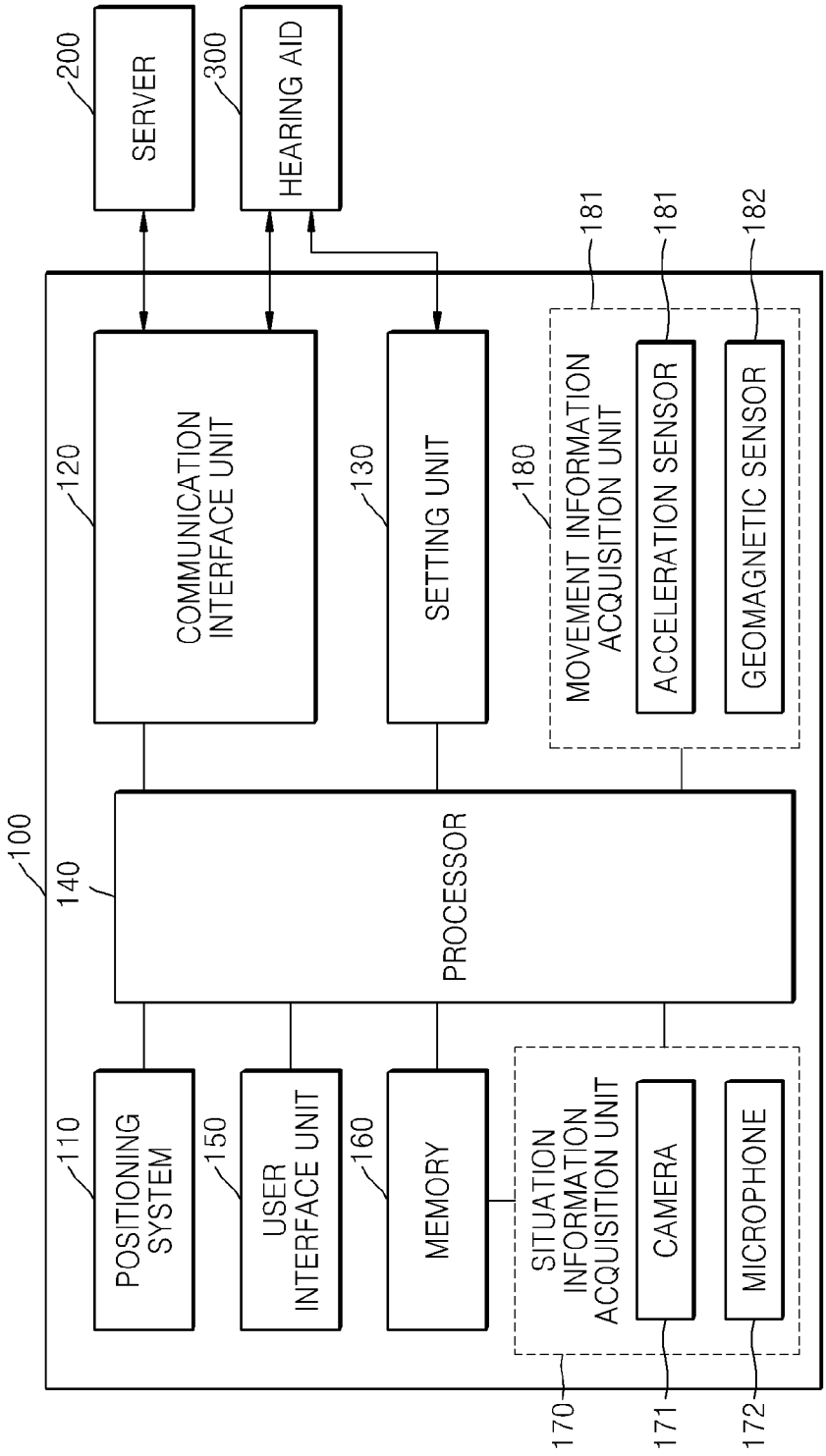

200
SERVER
300
HEARING AID
181
181
182
120
COMMUNICATION INTERFACE UNIT
130
SETTING UNIT
180
MOVEMENT INFORMATION ACQUISITION UNIT
ACCELERATION SENSOR
GEOMAGNETIC SENSOR
100
140
PROCESSOR
110
POSITIONING SYSTEM
150
USER INTERFACE UNIT
160
MEMORY
SITUATION INFORMATION ACQUISITION UNIT
CAMERA
MICROPHONE
170
171
172

FIG. 4

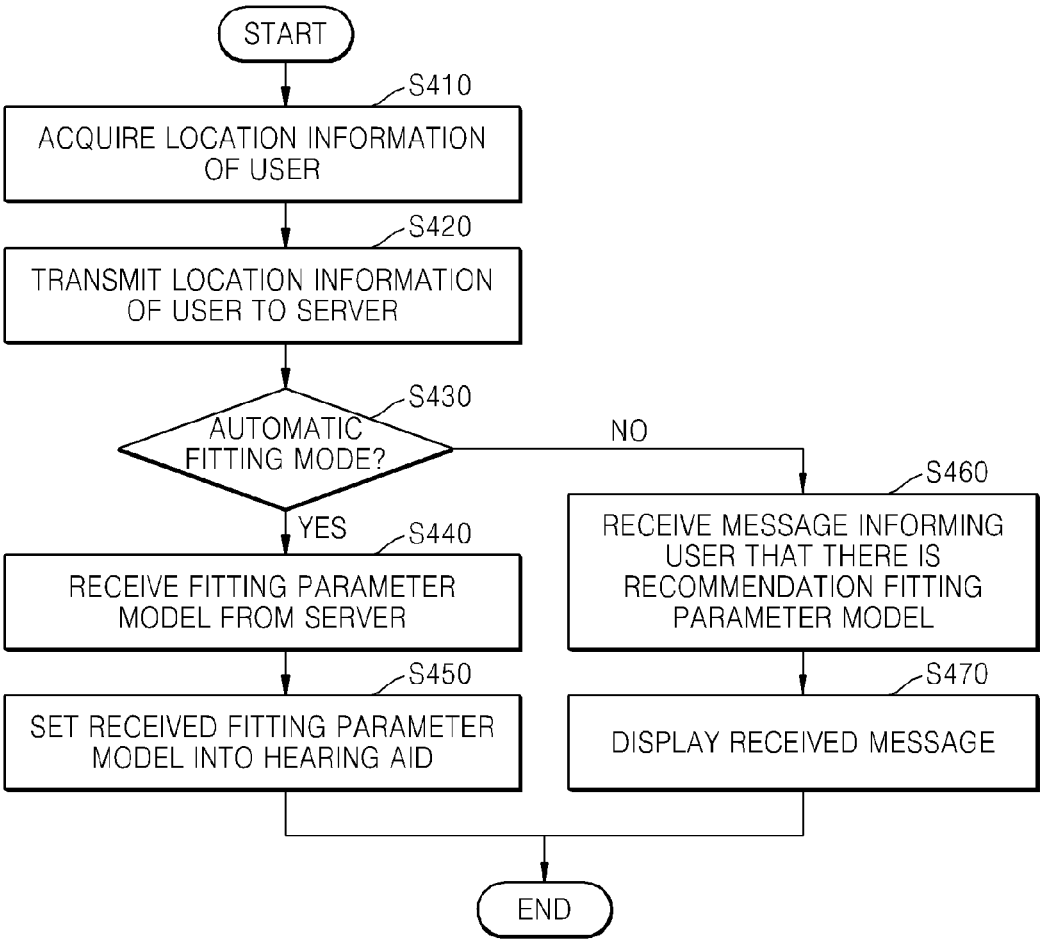

START
S410
ACQUIRE LOCATION INFORMATION OF USER
S420
TRANSMIT LOCATION INFORMATION OF USER TO SERVER
S430
AUTOMATIC FITTING MODE?
NO
YES
S440
RECEIVE FITTING PARAMETER MODEL FROM SERVER
S450
SET RECEIVED FITTING PARAMETER MODEL INTO HEARING AID
S460
RECEIVE MESSAGE INFORMING USER THAT THERE IS RECOMMENDATION FITTING PARAMETER MODEL
S470
DISPLAY RECEIVED MESSAGE
END

FIG. 5

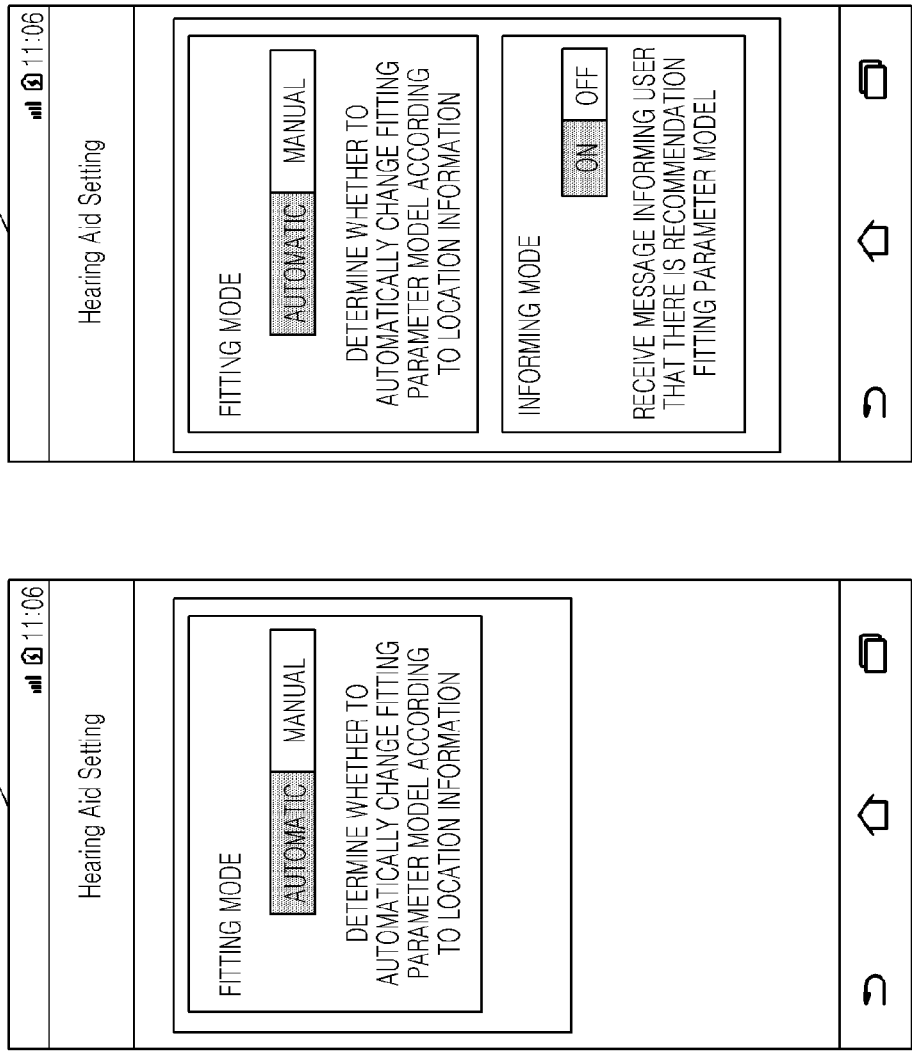

510
11:06
Hearing Aid Setting
FITTING MODE
AUTOMATIC
MANUAL
DETERMINE WHETHER TO AUTOMATICALLY CHANGE FITTING PARAMETER MODEL ACCORDING TO LOCATION INFORMATION
520
11:06
Hearing Aid Setting
FITTING MODE
AUTOMATIC
MANUAL
DETERMINE WHETHER TO AUTOMATICALLY CHANGE FITTING PARAMETER MODEL ACCORDING TO LOCATION INFORMATION
INFORMING MODE
ON
OFF
RECEIVE MESSAGE INFORMING USER THAT THERE IS RECOMMENDATION FITTING PARAMETER MODEL

FIG. 6A

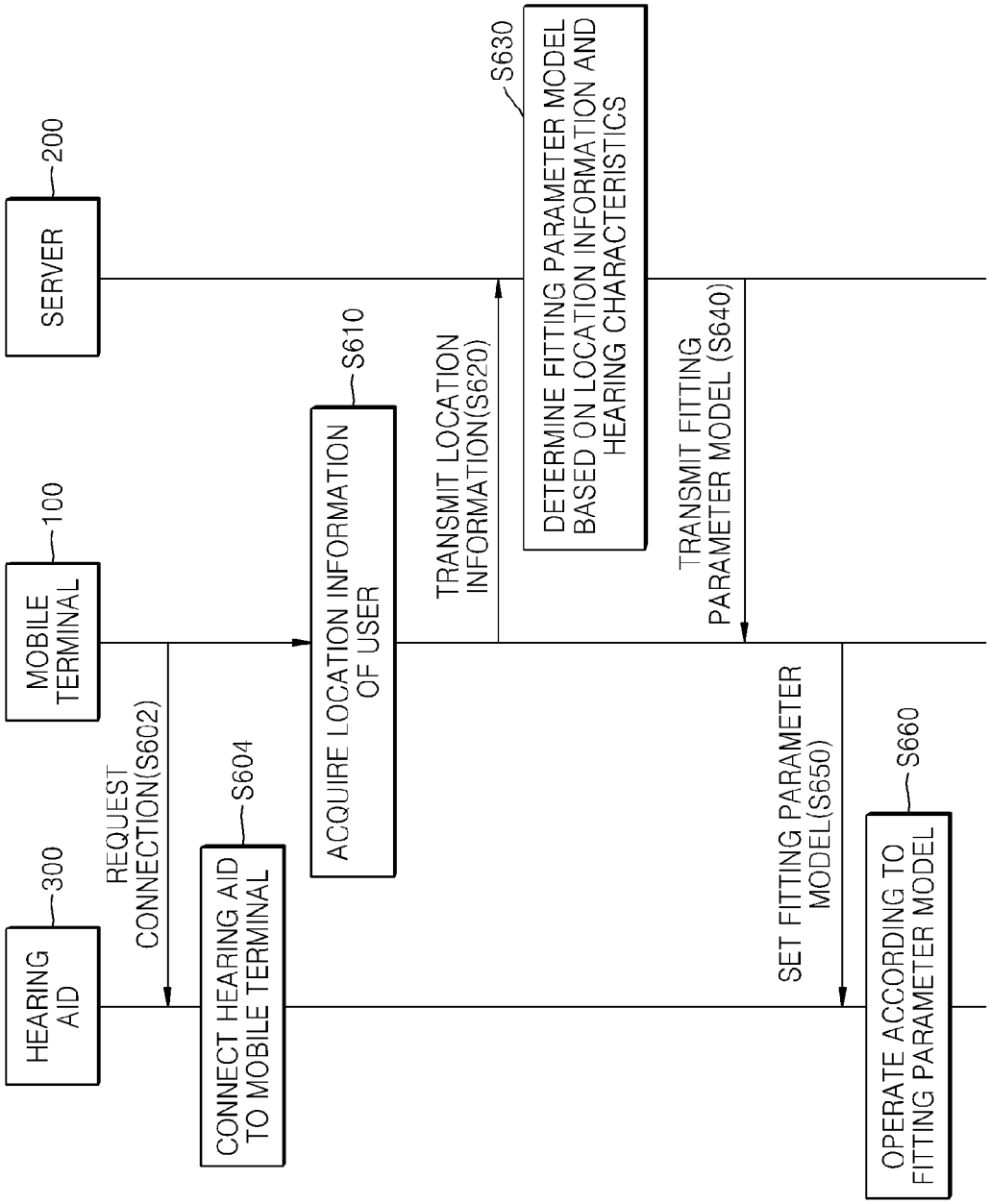

HEARING AID
300
MOBILE TERMINAL
100
SERVER
200
REQUEST CONNECTION(S602)
CONNECT HEARING AID TO MOBILE TERMINAL
S604
ACQUIRE LOCATION INFORMATION OF USER
S610
TRANSMIT LOCATION INFORMATION(S620)
DETERMINE FITTING PARAMETER MODEL BASED ON LOCATION INFORMATION AND HEARING CHARACTERISTICS
S630
TRANSMIT FITTING PARAMETER MODEL (S640)
SET FITTING PARAMETER MODEL(S650)
OPERATE ACCORDING TO FITTING PARAMETER MODEL
S660

FIG. 6B

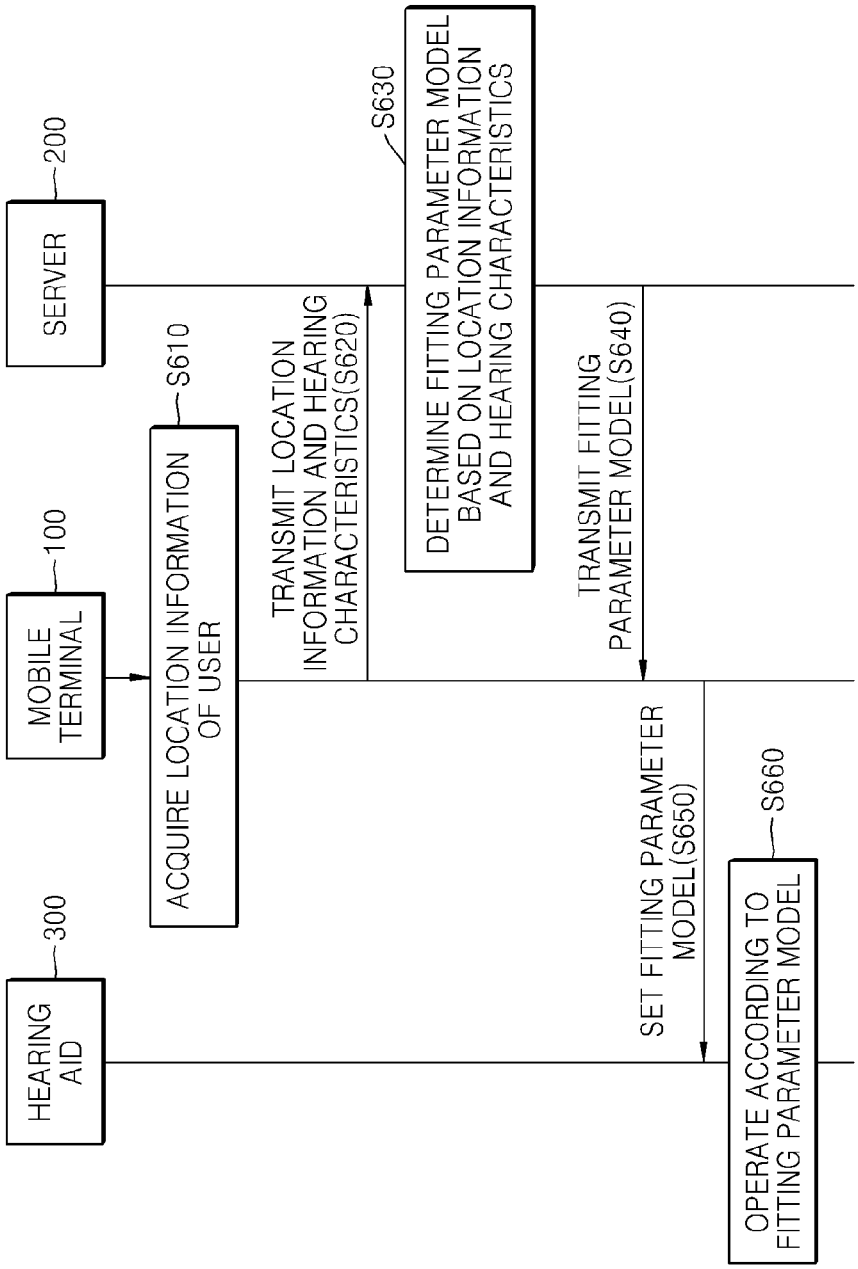

SERVER
200
MOBILE TERMINAL
100
HEARING AID
300
ACQUIRE LOCATION INFORMATION OF USER
S610
TRANSMIT LOCATION INFORMATION AND HEARING CHARACTERISTICS(S620)
DETERMINE FITTING PARAMETER MODEL BASED ON LOCATION INFORMATION AND HEARING CHARACTERISTICS
S630
TRANSMIT FITTING PARAMETER MODEL(S640)
SET FITTING PARAMETER MODEL(S650)
OPERATE ACCORDING TO FITTING PARAMETER MODEL
S660

FIG. 6C

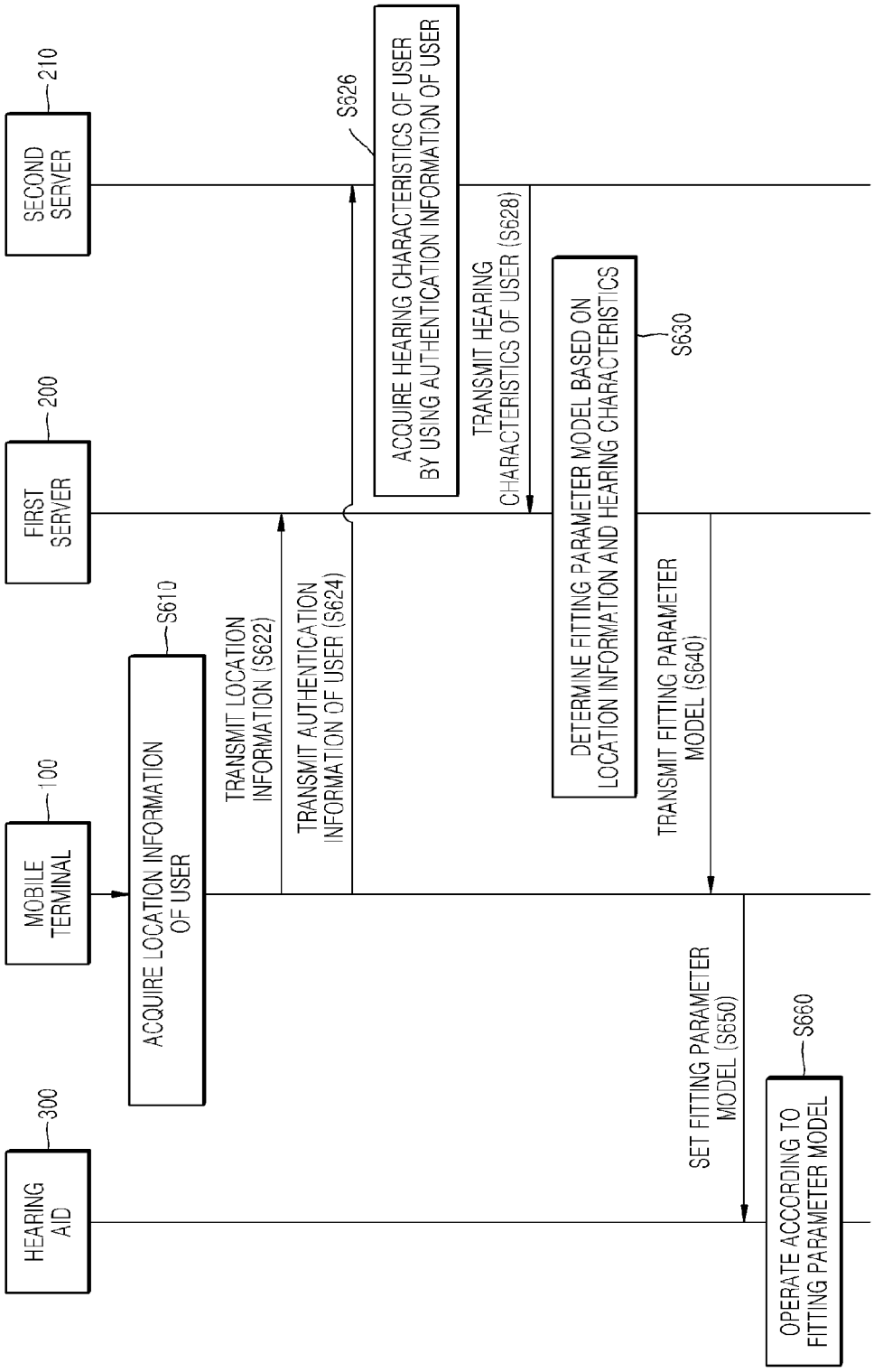

HEARING AID
300
MOBILE TERMINAL
100
FIRST SERVER
200
SECOND SERVER
210
ACQUIRE LOCATION INFORMATION OF USER
S610
TRANSMIT LOCATION INFORMATION (S622)
TRANSMIT AUTHENTICATION INFORMATION OF USER (S624)
ACQUIRE HEARING CHARACTERISTICS OF USER BY USING AUTHENTICATION INFORMATION OF USER
S626
TRANSMIT HEARING CHARACTERISTICS OF USER (S628)
DETERMINE FITTING PARAMETER MODEL BASED ON LOCATION INFORMATION AND HEARING CHARACTERISTICS
S630
TRANSMIT FITTING PARAMETER MODEL (S640)
SET FITTING PARAMETER MODEL (S650)
OPERATE ACCORDING TO FITTING PARAMETER MODEL
S660

FIG. 7

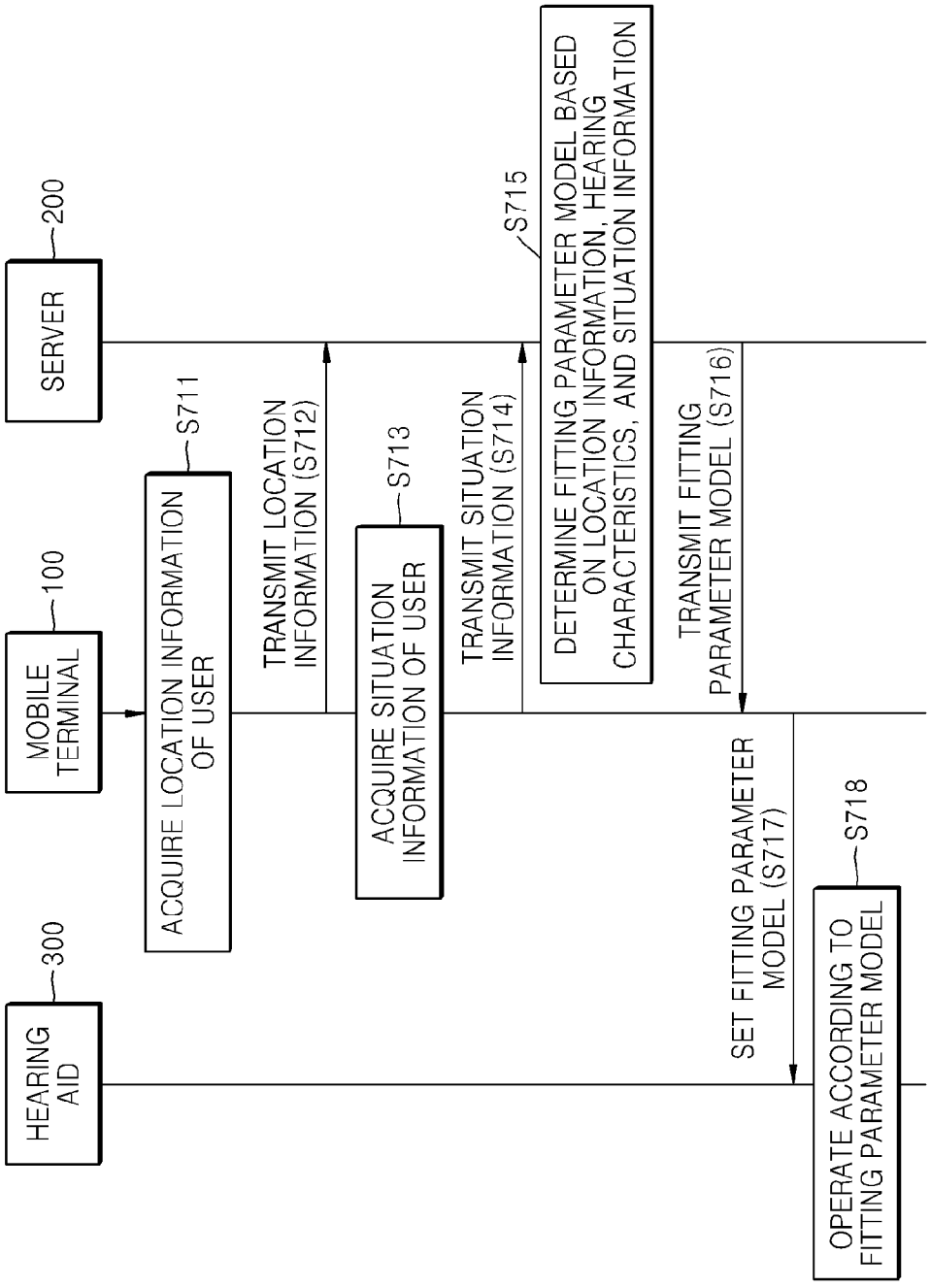

HEARING AID
300
MOBILE TERMINAL
100
SERVER
200
ACQUIRE LOCATION INFORMATION OF USER
S711
TRANSMIT LOCATION INFORMATION (S712)
ACQUIRE SITUATION INFORMATION OF USER
S713
TRANSMIT SITUATION INFORMATION (S714)
S715
DETERMINE FITTING PARAMETER MODEL BASED ON LOCATION INFORMATION, HEARING CHARACTERISTICS, AND SITUATION INFORMATION
TRANSMIT FITTING PARAMETER MODEL (S716)
SET FITTING PARAMETER MODEL (S717)
OPERATE ACCORDING TO FITTING PARAMETER MODEL
S718

FIG. 8

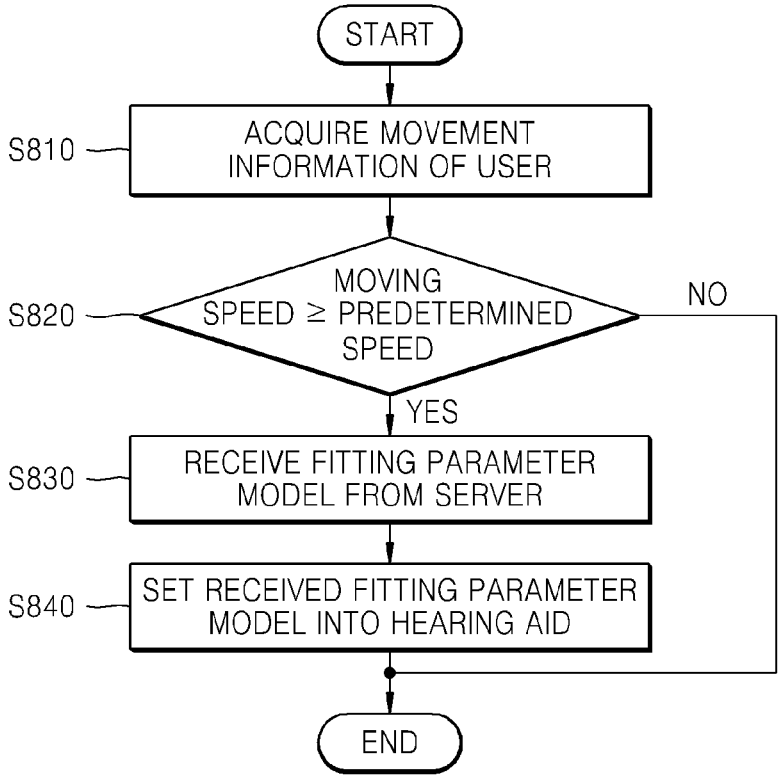

START
S810
ACQUIRE MOVEMENT INFORMATION OF USER
S820
MOVING SPEED ≥ PREDETERMINED SPEED
NO
YES
S830
RECEIVE FITTING PARAMETER MODEL FROM SERVER
S840
SET RECEIVED FITTING PARAMETER MODEL INTO HEARING AID
END

FIG. 9

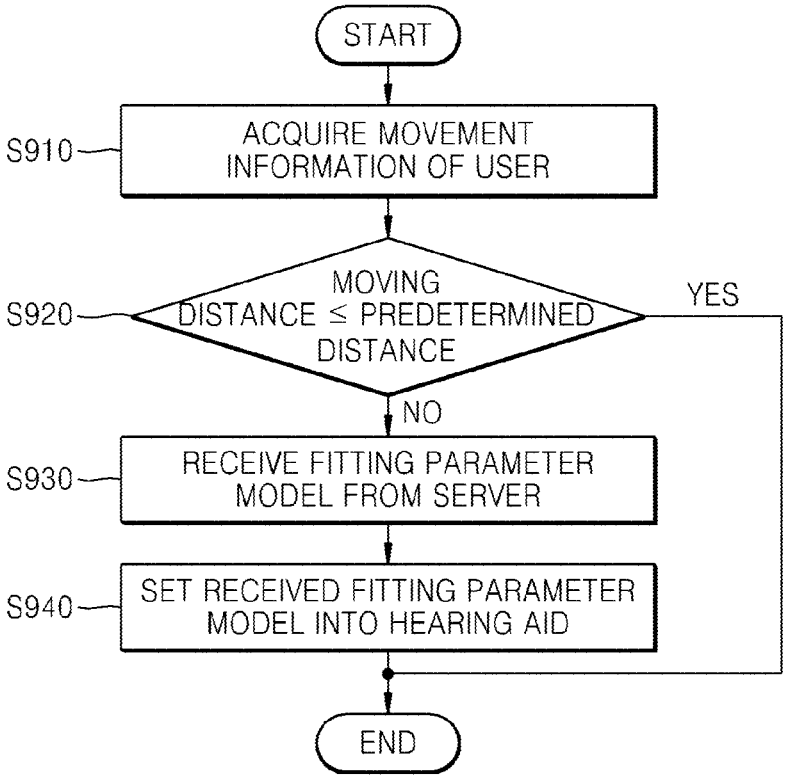

START
S910
ACQUIRE MOVEMENT INFORMATION OF USER
S920
MOVING DISTANCE ≤ PREDETERMINED DISTANCE
YES
NO
S930
RECEIVE FITTING PARAMETER MODEL FROM SERVER
S940
SET RECEIVED FITTING PARAMETER MODEL INTO HEARING AID
END

FIG. 10

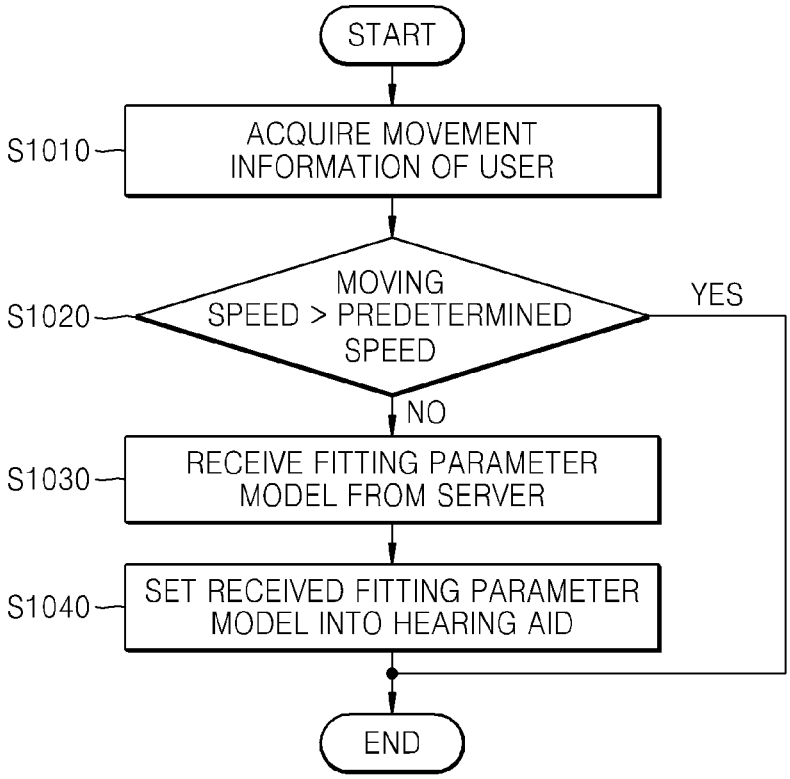

START
S1010
ACQUIRE MOVEMENT INFORMATION OF USER
S1020
MOVING SPEED > PREDETERMINED SPEED
YES
NO
S1030
RECEIVE FITTING PARAMETER MODEL FROM SERVER
S1040
SET RECEIVED FITTING PARAMETER MODEL INTO HEARING AID
END

FIG. 11

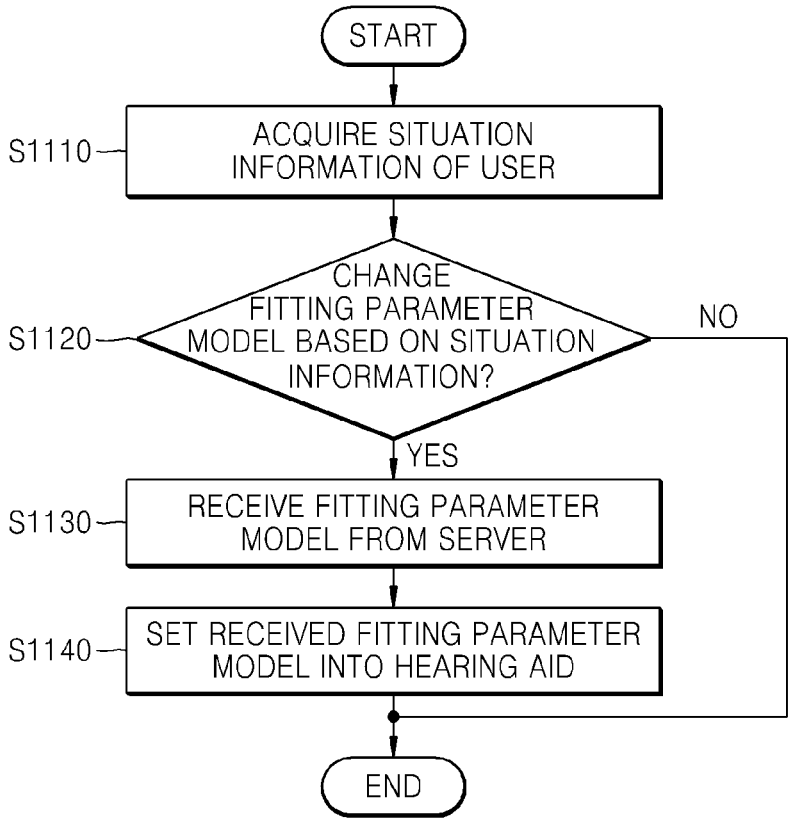

START
S1110
ACQUIRE SITUATION INFORMATION OF USER
S1120
CHANGE FITTING PARAMETER MODEL BASED ON SITUATION INFORMATION?
NO
YES
S1130
RECEIVE FITTING PARAMETER MODEL FROM SERVER
S1140
SET RECEIVED FITTING PARAMETER MODEL INTO HEARING AID
END

FIG. 12

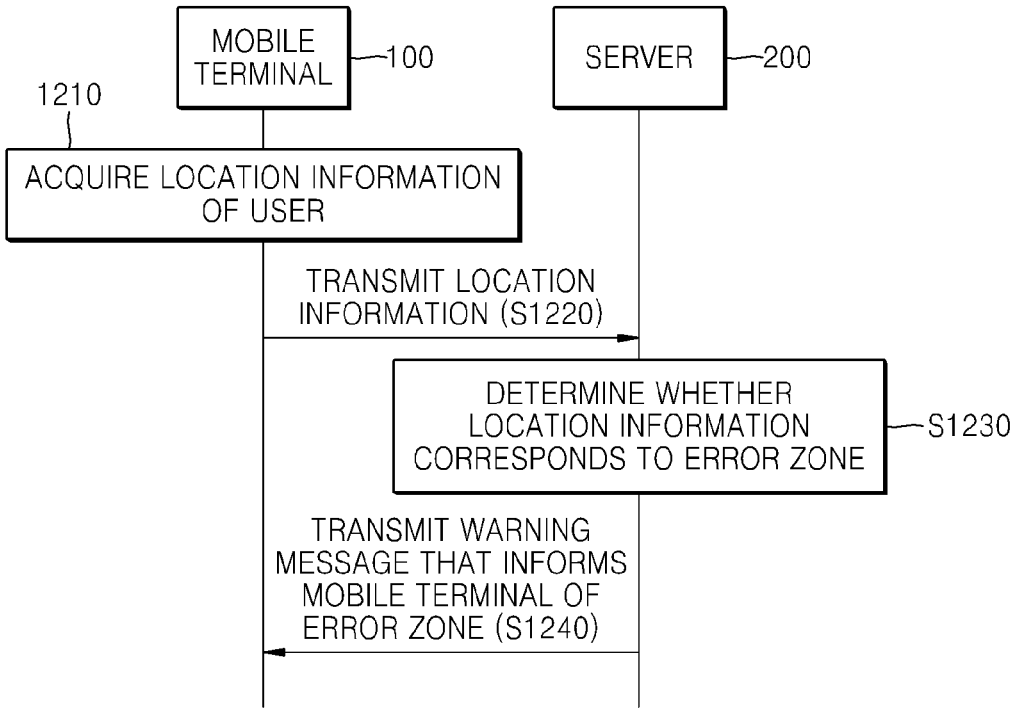

MOBILE TERMINAL
100
SERVER
200
1210
ACQUIRE LOCATION INFORMATION OF USER
TRANSMIT LOCATION INFORMATION (S1220)
DETERMINE WHETHER LOCATION INFORMATION CORRESPONDS TO ERROR ZONE
S1230
TRANSMIT WARNING MESSAGE THAT INFORMS MOBILE TERMINAL OF ERROR ZONE (S1240)

FIG. 13

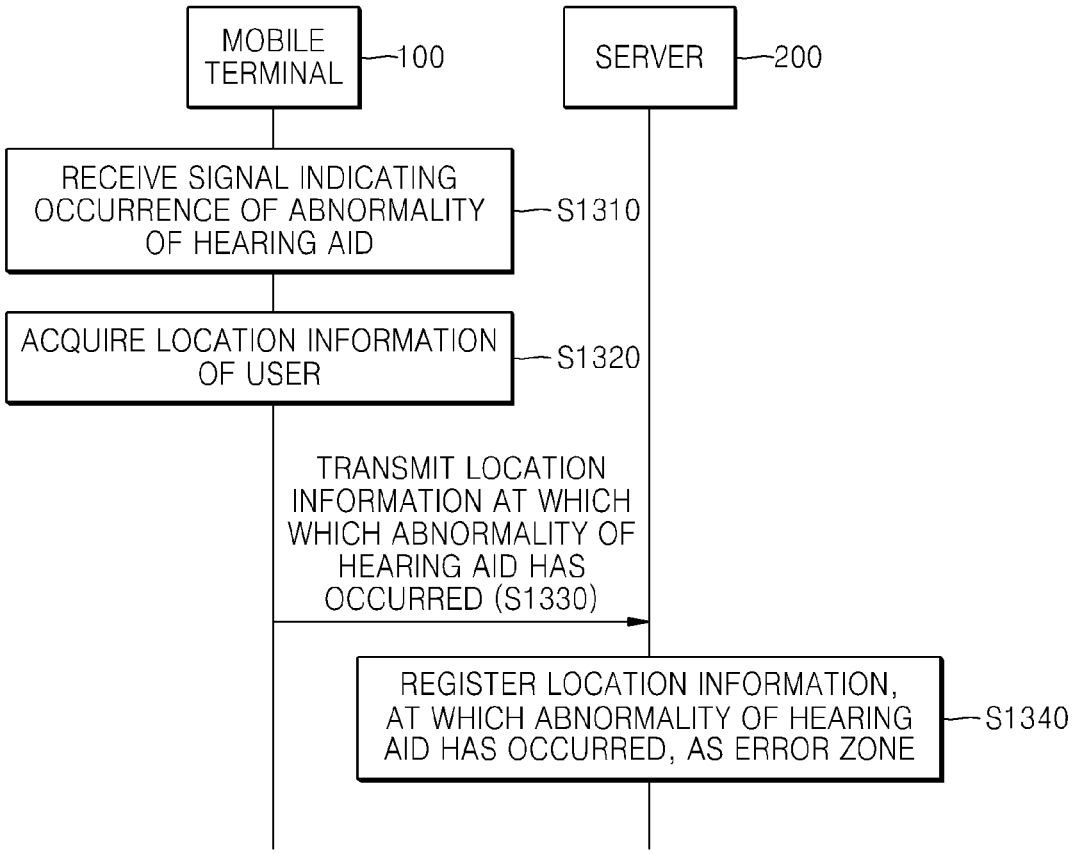

MOBILE TERMINAL
100
SERVER
200
RECEIVE SIGNAL INDICATING OCCURRENCE OF ABNORMALITY OF HEARING AID
S1310
ACQUIRE LOCATION INFORMATION OF USER
S1320
TRANSMIT LOCATION INFORMATION AT WHICH WHICH ABNORMALITY OF HEARING AID HAS OCCURRED (S1330)
REGISTER LOCATION INFORMATION, AT WHICH ABNORMALITY OF HEARING AID HAS OCCURRED, AS ERROR ZONE
S1340

FIG. 14

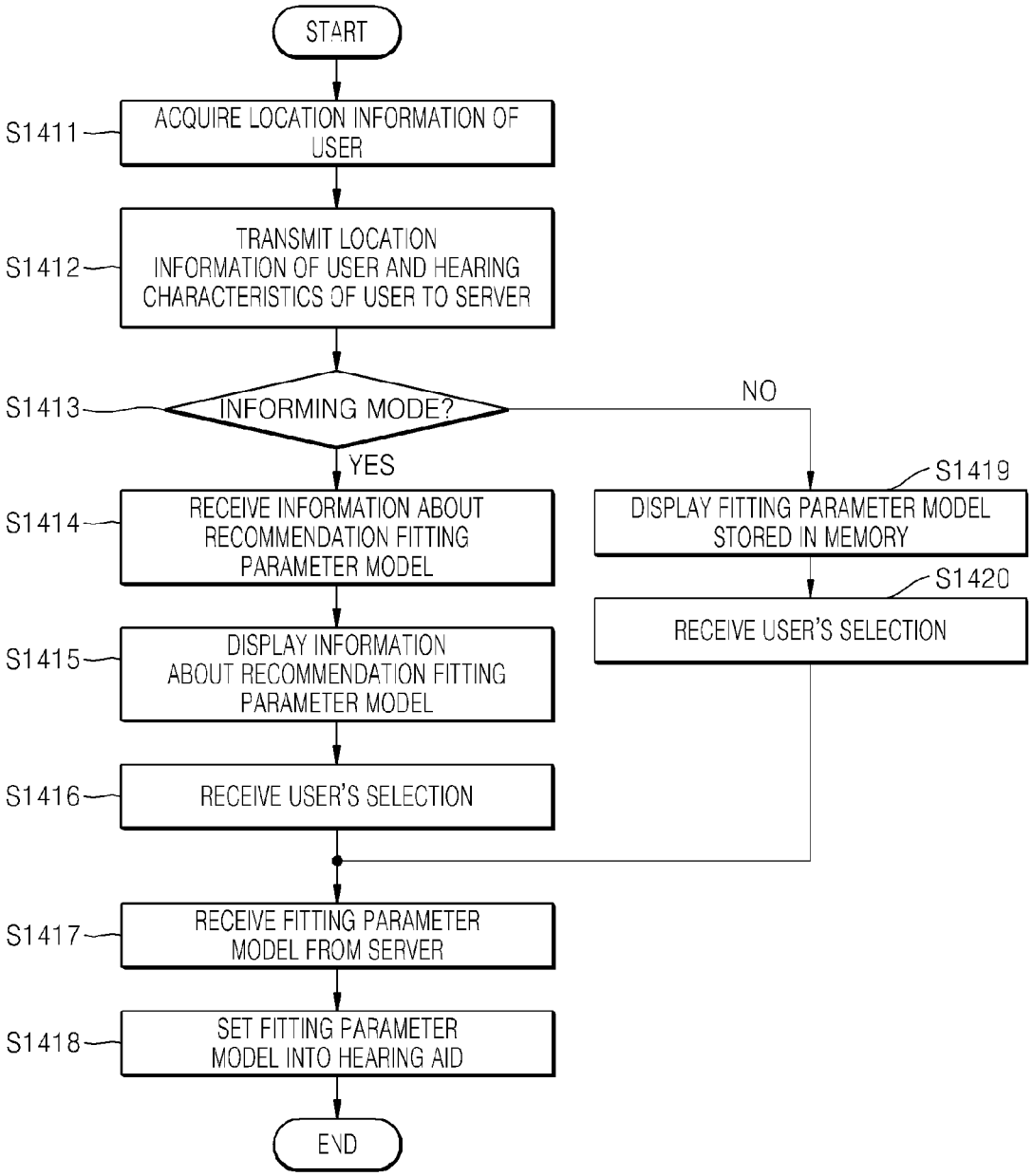

START
S1411
ACQUIRE LOCATION INFORMATION OF USER
S1412
TRANSMIT LOCATION INFORMATION OF USER AND HEARING CHARACTERISTICS OF USER TO SERVER
S1413
INFORMING MODE?
NO
YES
S1414
RECEIVE INFORMATION ABOUT RECOMMENDATION FITTING PARAMETER MODEL
S1415
DISPLAY INFORMATION ABOUT RECOMMENDATION FITTING PARAMETER MODEL
S1416
RECEIVE USER'S SELECTION
S1419
DISPLAY FITTING PARAMETER MODEL STORED IN MEMORY
S1420
RECEIVE USER'S SELECTION
S1417
RECEIVE FITTING PARAMETER MODEL FROM SERVER
S1418
SET FITTING PARAMETER MODEL INTO HEARING AID
END

FIG. 15

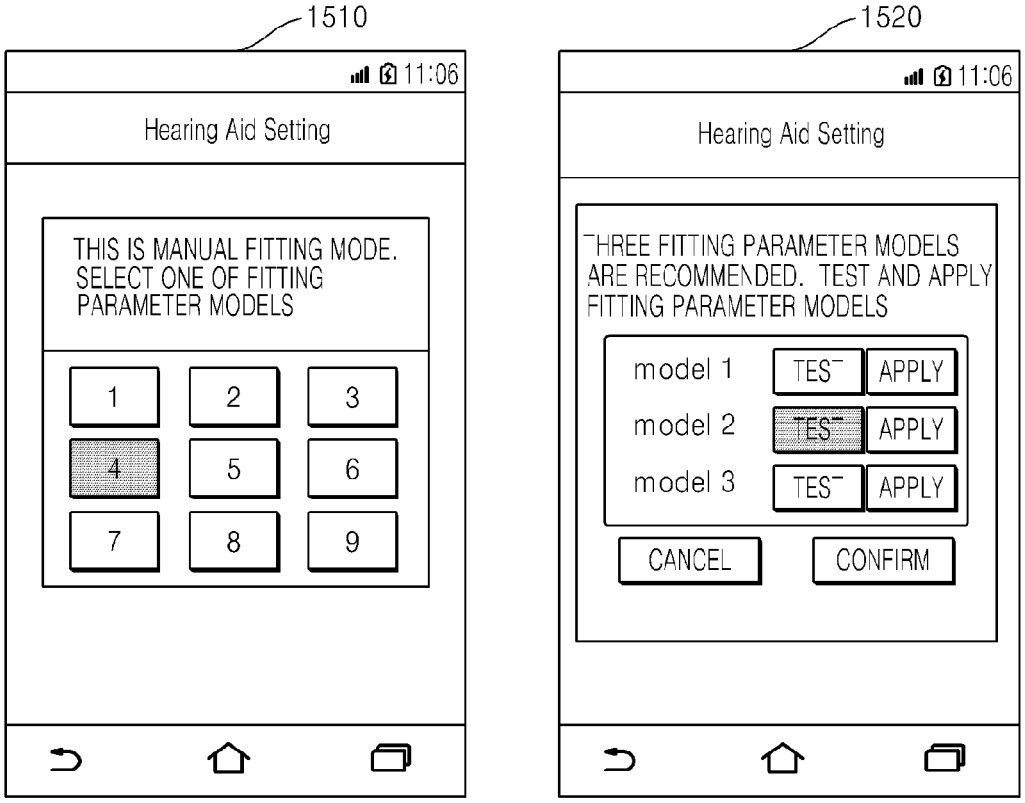

1510
11:06
Hearing Aid Setting
THIS IS MANUAL FITTING MODE. SELECT ONE OF FITTING PARAMETER MODELS
1
2
3
4
5
6
7
8
9
1520
11:06
Hearing Aid Setting
THREE FITTING PARAMETER MODELS ARE RECOMMENDED. TEST AND APPLY FITTING PARAMETER MODELS
model 1
TEST
APPLY
model 2
TEST
APPLY
model 3
TEST
APPLY
CANCEL
CONFIRM

FIG. 16

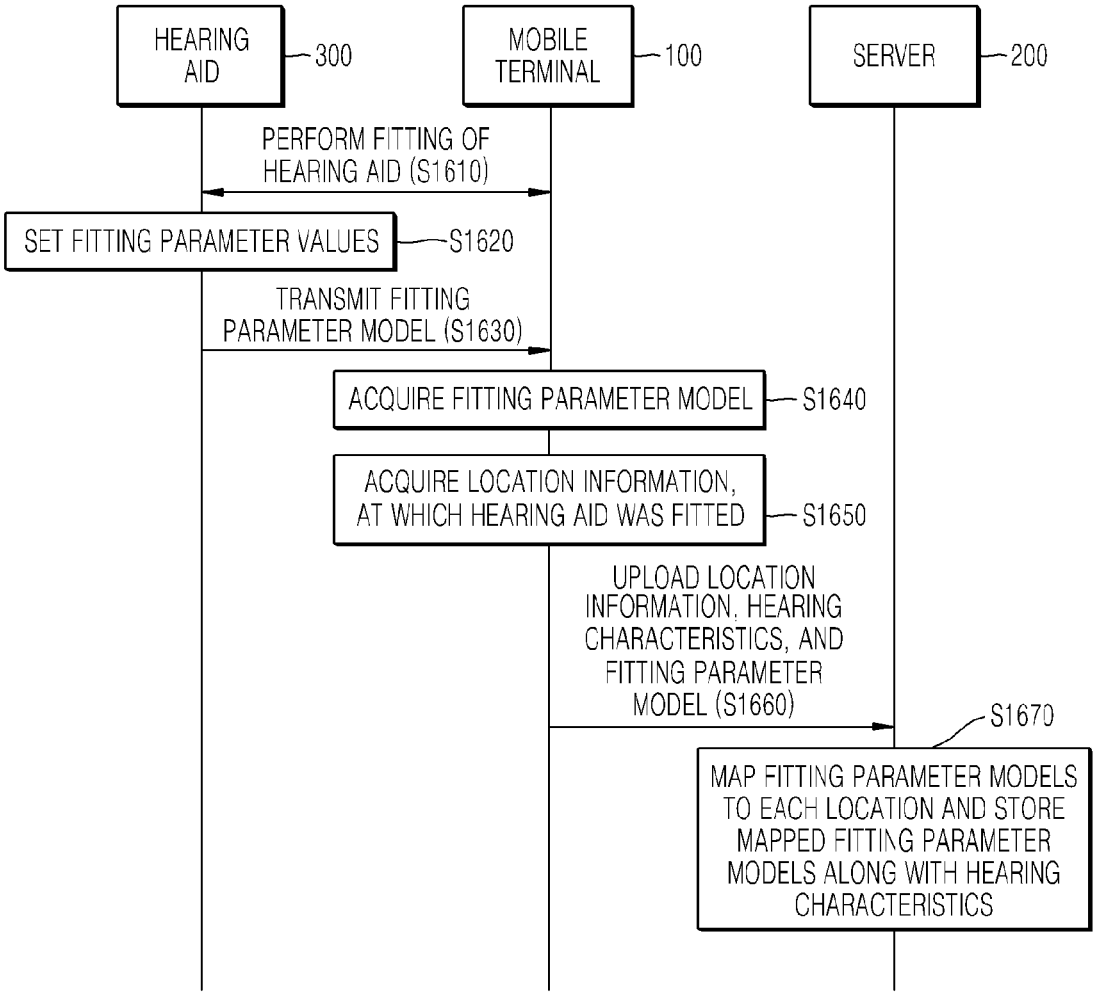

HEARING AID
300
MOBILE TERMINAL
100
SERVER
200
PERFORM FITTING OF HEARING AID (S1610)
SET FITTING PARAMETER VALUES
S1620
TRANSMIT FITTING PARAMETER MODEL (S1630)
ACQUIRE FITTING PARAMETER MODEL
S1640
ACQUIRE LOCATION INFORMATION, AT WHICH HEARING AID WAS FITTED
S1650
UPLOAD LOCATION INFORMATION, HEARING CHARACTERISTICS, AND FITTING PARAMETER MODEL (S1660)
S1670
MAP FITTING PARAMETER MODELS TO EACH LOCATION AND STORE MAPPED FITTING PARAMETER MODELS ALONG WITH HEARING CHARACTERISTICS

FIG. 17

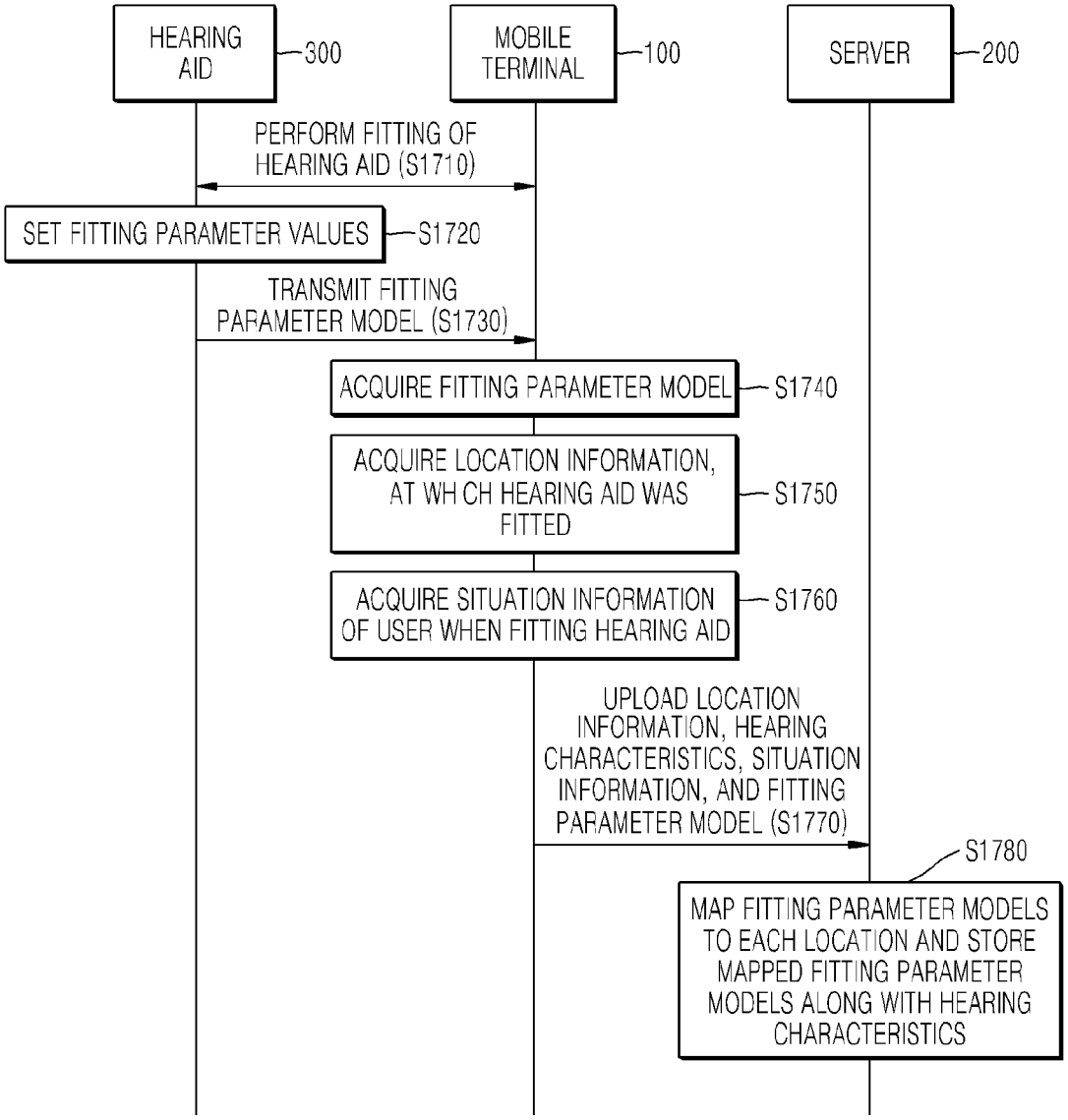

HEARING AID
300
MOBILE TERMINAL
100
SERVER
200
PERFORM FITTING OF HEARING AID (S1710)
SET FITTING PARAMETER VALUES
S1720
TRANSMIT FITTING PARAMETER MODEL (S1730)
ACQUIRE FITTING PARAMETER MODEL
S1740
ACQUIRE LOCATION INFORMATION, AT WH CH HEARING AID WAS FITTED
S1750
ACQUIRE SITUATION INFORMATION OF USER WHEN FITTING HEARING AID
S1760
UPLOAD LOCATION INFORMATION, HEARING CHARACTERISTICS, SITUATION INFORMATION, AND FITTING PARAMETER MODEL (S1770)
S1780
MAP FITTING PARAMETER MODELS TO EACH LOCATION AND STORE MAPPED FITTING PARAMETER MODELS ALONG WITH HEARING CHARACTERISTICS

FIG. 18

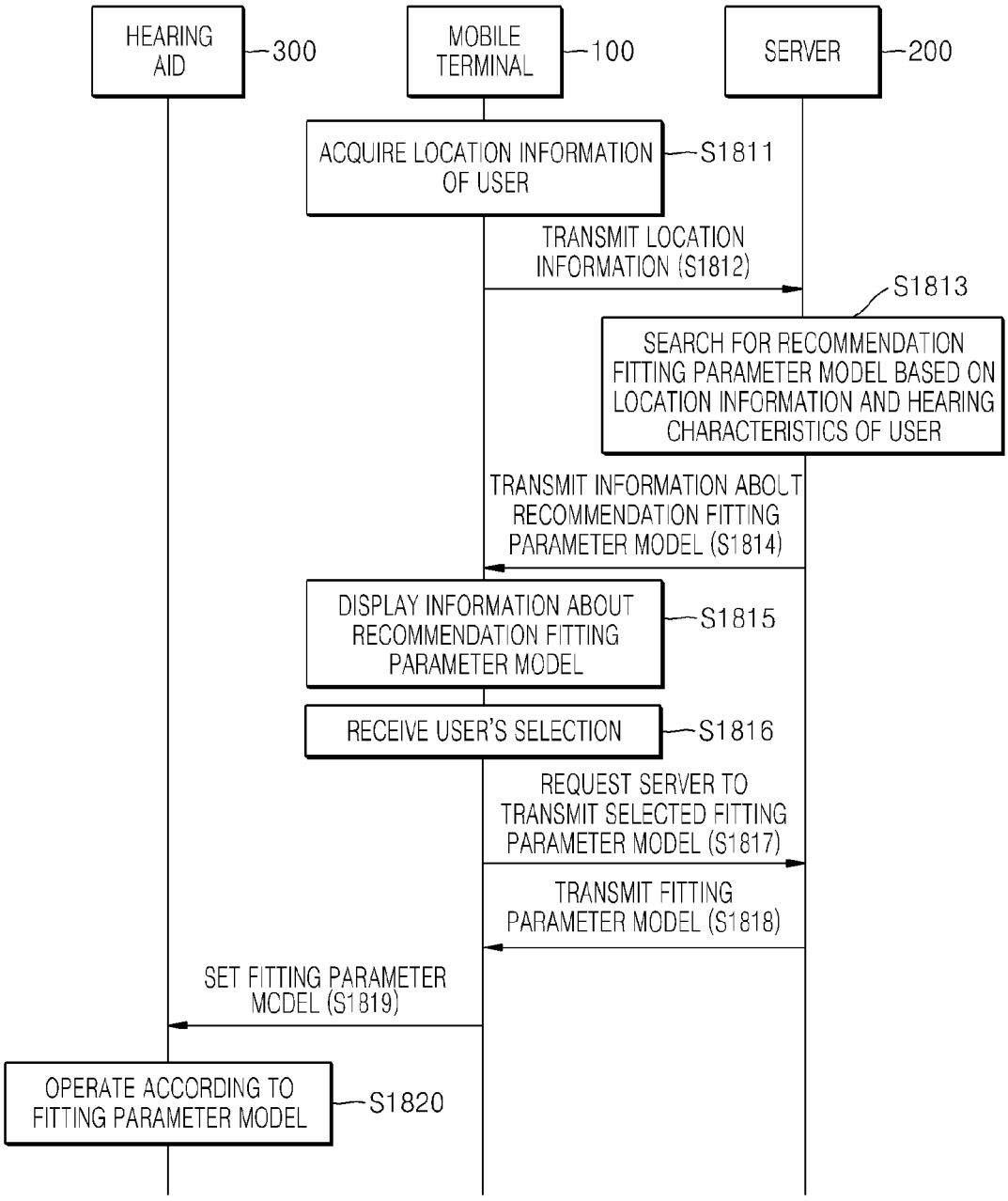

HEARING AID
300
MOBILE TERMINAL
100
SERVER
200
ACQUIRE LOCATION INFORMATION OF USER
S1811
TRANSMIT LOCATION INFORMATION (S1812)
S1813
SEARCH FOR RECOMMENDATION FITTING PARAMETER MODEL BASED ON LOCATION INFORMATION AND HEARING CHARACTERISTICS OF USER
TRANSMIT INFORMATION ABOUT RECOMMENDATION FITTING PARAMETER MODEL (S1814)
DISPLAY INFORMATION ABOUT RECOMMENDATION FITTING PARAMETER MODEL
S1815
RECEIVE USER'S SELECTION
S1816
REQUEST SERVER TO TRANSMIT SELECTED FITTING PARAMETER MODEL (S1817)
TRANSMIT FITTING PARAMETER MODEL (S1818)
SET FITTING PARAMETER MODEL (S1819)
OPERATE ACCORDING TO FITTING PARAMETER MODEL
S1820

FIG. 19

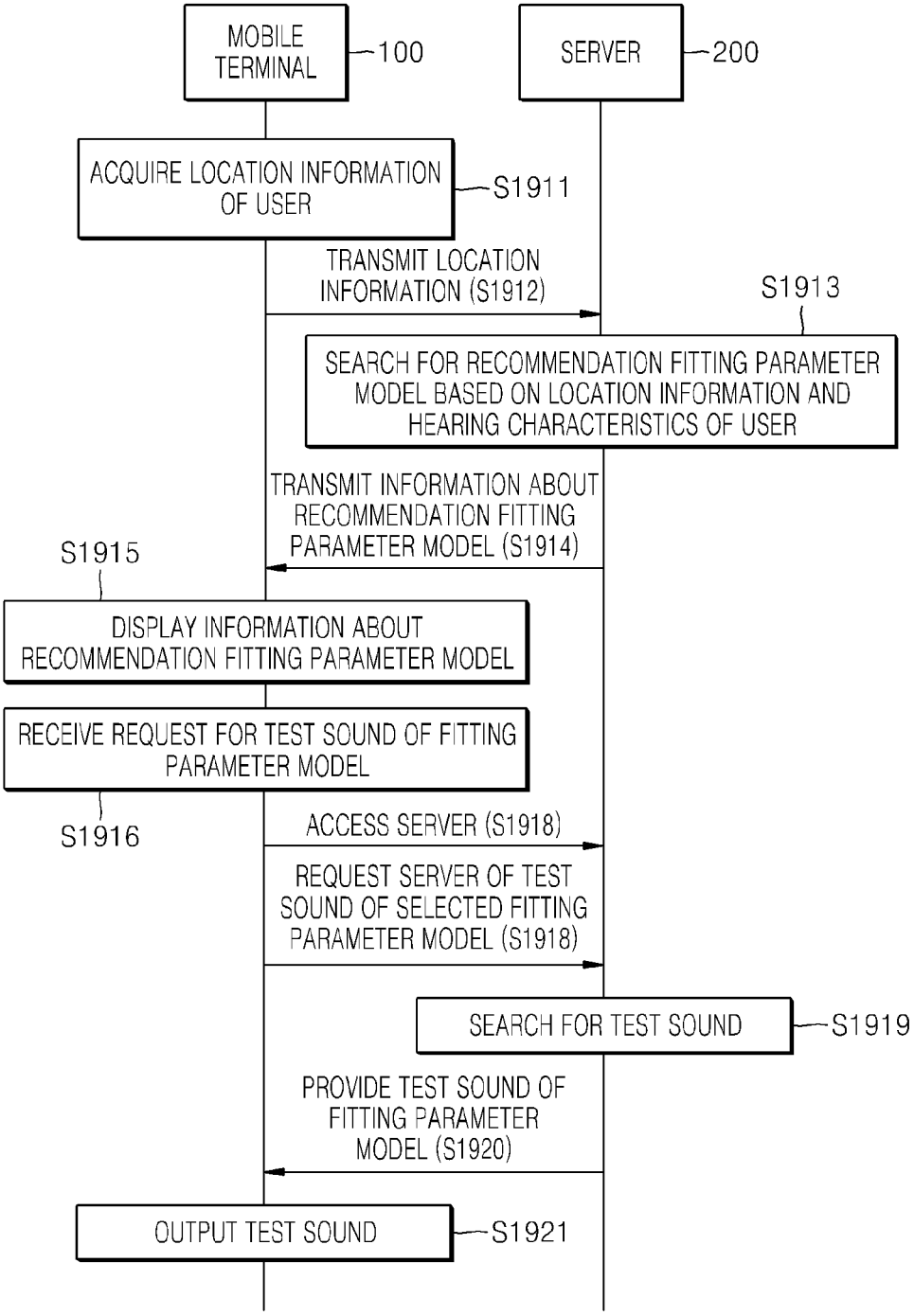
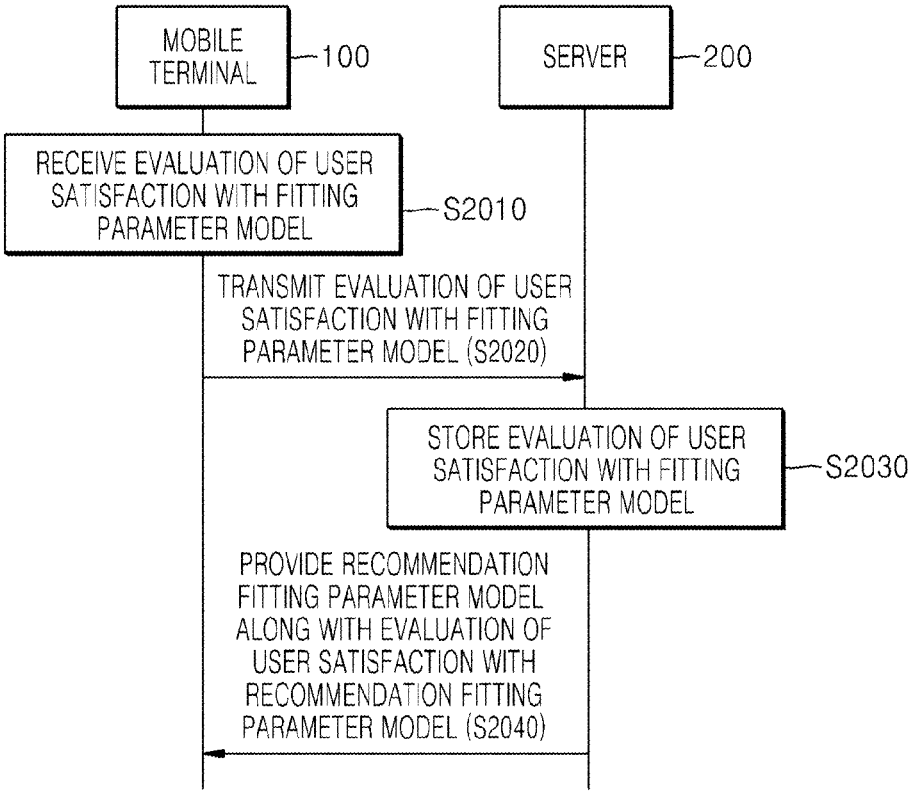

MOBILE TERMINAL
100
SERVER
200
ACQUIRE LOCATION INFORMATION OF USER
S1911
TRANSMIT LOCATION INFORMATION (S1912)
S1913
SEARCH FOR RECOMMENDATION FITTING PARAMETER MODEL BASED ON LOCATION INFORMATION AND HEARING CHARACTERISTICS OF USER
TRANSMIT INFORMATION ABOUT RECOMMENDATION FITTING PARAMETER MODEL (S1914)
S1915
DISPLAY INFORMATION ABOUT RECOMMENDATION FITTING PARAMETER MODEL
RECEIVE REQUEST FOR TEST SOUND OF FITTING PARAMETER MODEL
S1916
ACCESS SERVER (S1918)
REQUEST SERVER OF TEST SOUND OF SELECTED FITTING PARAMETER MODEL (S1918)
SEARCH FOR TEST SOUND
S1919
PROVIDE TEST SOUND OF FITTING PARAMETER MODEL (S1920)
OUTPUT TEST SOUND
S1921

FIG. 20


MOBILE TERMINAL
100
SERVER
200
RECEIVE EVALUATION OF USER SATISFACTION WITH FITTING PARAMETER MODEL
S2010
TRANSMIT EVALUATION OF USER SATISFACTION WITH FITTING PARAMETER MODEL (S2020)
STORE EVALUATION OF USER SATISFACTION WITH FITTING PARAMETER MODEL
S2030
PROVIDE RECOMMENDATION FITTING PARAMETER MODEL ALONG WITH EVALUATION OF USER SATISFACTION WITH RECOMMENDATION FITTING PARAMETER MODEL (S2040)

METHOD OF FITTING HEARING AID CONNECTED TO MOBILE TERMINAL AND MOBILE TERMINAL PERFORMING THE METHOD

CROSS-REFERENCE TO RELATED PATENT APPLICATION

This application claims priority from Korean Patent Application No. 10-2013-0011498, filed in the Korean Intellectual Property Office on Jan. 31, 2013, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

1. Field

Apparatuses and methods consistent with exemplary embodiments relate to a method of fitting a hearing aid connected to a mobile terminal and a mobile terminal performing the method.

2. Description of the Related Art

Hearing loss has increased partially due to the use of sound systems, an increase in the elderly population, and an increase in noisy environments. Due to the increase in demand for hearing aids and the development of digital hearing aids, there is also an increase in demand for high performance hearing aids capable of providing sounds properly fitted to various situations and surroundings of users' daily lives.

SUMMARY

One or more exemplary embodiments provide a method of fitting a hearing aid connected to a mobile terminal and a mobile terminal performing the method.

One or more exemplary embodiments also provide a computer recordable recording medium having stored thereon a program for executing the method.

According to an aspect of an exemplary embodiment, there is provided a method of fitting a hearing aid connected to a mobile terminal, the method including: acquiring location information of a location of the mobile terminal; transmitting the location information to a server; receiving, from the server, a fitting parameter model adapted to hearing conditions of the location and hearing characteristics of a user of the hearing aid; and controlling the hearing aid to function according to the received fitting parameter model.

According to another aspect of an exemplary embodiment, there is provided a method of fitting a hearing aid connected to a mobile terminal, the method including: acquiring location information of a location of the mobile terminal; transmitting the location information to a server; receiving, from the server, information about at least one recommended fitting parameter model adapted to hearing conditions of the location and hearing characteristics of a user of the hearing aid; displaying the information about the at least one recommended fitting parameter model; receiving a fitting parameter model selected by the user from among the at least one recommended fitting parameter model; and controlling the hearing aid to function according to the received fitting parameter model.

According to another aspect of an exemplary embodiment, there is provided a non-transitory computer-readable recording medium having recorded thereon a program for executing any one of the methods.

According to another aspect of an exemplary embodiment, there is provided a mobile terminal connected to a hearing aid, the mobile terminal including: a positioning system configured to acquire location information about a location of the mobile terminal; a communication interface configured to transmit the location information of the mobile terminal to a server, and receive, from the server, a fitting parameter model corresponding to hearing characteristics of the user from among fitting parameter models of the hearing aid, that are mapped to the location; and a setting unit configured to transmit a signal to control the hearing aid according to the received fitting parameter model.

As described above, by acquiring the current location of a user by using a positioning system, receiving a fitting parameter model fitted to be suitable for the current location of the mobile terminal from a server, and changing the current fitting parameter model of a hearing aid for the received fitting parameter model, the user may use a hearing aid fitted with a fitting parameter model optimized according to the current location. The fitting parameter model received from the server is a fitting parameter model fitted in consideration of location characteristics and surroundings, and thus, the hearing aid may provide a sound fitted to be suitable for various situations and various surroundings of the user's daily life.

In addition, the user may automatically or manually set a fitting parameter model fitted to be suitable for the location of the user into the hearing aid, and thus, the user's convenience may be greatly improved.

Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the presented embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and aspects will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

FIG. **1** is a diagram for explaining an environment for fitting a hearing aid by using a global positioning system (GPS) in a mobile terminal, according to an exemplary embodiment;

FIG. **2** is a diagram for explaining a method of providing a fitting parameter model corresponding to a location of each user from a server to each user's mobile terminal, according to an exemplary embodiment;

FIG. **3** is a block diagram of a mobile terminal according to an exemplary embodiment;

FIG. **4** is a flowchart illustrating a method of fitting a hearing aid by using a positioning system in a mobile terminal, according to an exemplary embodiment;

FIG. **5** is a diagram illustrating a screen for setting a fitting mode in a mobile terminal, according to an exemplary embodiment;

FIG. **6**A is a flowchart illustrating a method of automatically fitting a hearing aid by using a positioning system in a mobile terminal, according to an exemplary embodiment;

FIG. **6**B is a flowchart illustrating a method of automatically fitting a hearing aid by using a positioning system in a mobile terminal, according to another exemplary embodiment;

FIG. **6**C is a flowchart illustrating a method of automatically fitting a hearing aid by using a positioning system in a mobile terminal, according to another exemplary embodiment

FIG. **7** is a flowchart illustrating a method of automatically fitting a hearing aid by using a positioning system in a mobile terminal, according to another exemplary embodiment;

FIG. **8** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of a hearing aid based on movement information of a user in an automatic fitting mode of a mobile terminal, according to an exemplary embodiment;

FIG. **9** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of a hearing aid based on movement information of a user in an automatic fitting mode of a mobile terminal, according to another exemplary embodiment;

FIG. **10** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of a hearing aid based on movement information of a user in an automatic fitting mode of a mobile terminal, according to another exemplary embodiment;

FIG. **11** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of a hearing aid based on situation information of a user in an automatic fitting mode of a mobile terminal, according to another exemplary embodiment;

FIG. **12** is a flowchart illustrating a method of informing a user of a hearing aid of an error zone by using a positioning system in a mobile terminal, according to an exemplary embodiment;

FIG. **13** is a flowchart illustrating a method of registering an error zone, in which an abnormality of a hearing aid has occurred, into a server by using a positioning system in a mobile terminal, according to an exemplary embodiment;

FIG. **14** is a flowchart illustrating a method of manually fitting a hearing aid by using a positioning system in a mobile terminal, according to another exemplary embodiment;

FIG. **15** illustrates screens for setting a fitting parameter model in a manual fitting mode of a mobile terminal, according to an exemplary embodiment;

FIG. **16** is a flowchart illustrating a method of fitting a hearing aid and uploading a fitted fitting parameter model in association with location information to a server, in a mobile terminal, according to an exemplary embodiment;

FIG. **17** is a flowchart illustrating a method of fitting a hearing aid and uploading a fitted fitting parameter model in association with location information to a server, in a mobile terminal, according to another exemplary embodiment;

FIG. **18** is a flowchart illustrating a method of setting a recommended fitting parameter model provided from a server into a hearing aid, in a mobile terminal, according to an exemplary embodiment;

FIG. **19** is a flowchart illustrating a method of a providing a test sound of a fitting parameter model from a server to a mobile terminal, according to an exemplary embodiment; and

FIG. **20** is a flowchart illustrating a method of providing the evaluation of user satisfaction with a fitting parameter model, in a server, according to an exemplary embodiment.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The following detailed description is provided to assist the reader in gaining a comprehensive understanding of the methods, apparatuses, and/or systems described herein. Accordingly, various changes, modifications, and equivalents of the methods, apparatuses, and/or systems described herein will be suggested to those of ordinary skill in the art. The progression of processing steps and/or operations described is an example; however, the sequence of and/or operations is not limited to that set forth herein and may be changed as is known in the art, with the exception of steps and/or operations necessarily occurring in a particular order. In addition, respective descriptions of well-known functions and constructions may be omitted for increased clarity and conciseness.

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. In this regard, the present exemplary embodiments may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the exemplary embodiments are merely described below, by referring to the figures, to explain aspects of the present description. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

The term " . . . unit" used in the embodiments indicates a component including software or hardware, such as a Field Programmable Gate Array (FPGA) or an Application-Specific Integrated Circuit (ASIC), and the " . . . unit" performs certain roles. However, the " . . . unit" is not limited to software or hardware. The " . . . unit" may be configured to be included in an addressable storage medium or to reproduce one or more processors. Therefore, for example, the " . . . unit" includes components, such as software components, object-oriented software components, class components, and task components, processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, microcode, circuits, data, a database, data structures, tables, arrays, and variables. A function provided inside components and " . . . units" may be combined into a smaller number of components and " . . . units", or further divided into additional components and " . . . units".

The term "module" as used herein means, but is not limited to, a software or hardware component, such as an FPGA or ASIC, which performs certain tasks. A module may advantageously be configured to reside on an addressable storage medium and configured to execute on one or more processors. Thus, a module may include, by way of example, components, such as software components, object-oriented software components, class components and task components, processes, functions, attributes, procedures, subroutines, segments of program code, drivers, firmware, microcode, circuitry, data, databases, data structures, tables, arrays, and variables. The functionality provided for in the components and modules may be combined into fewer components and modules or further separated into additional components and modules.

Although the terms used herein are generic terms which are currently widely used and are selected by taking into consideration functions thereof, the meanings of the terms may vary according to the intentions of persons skilled in the art, legal precedents, or the emergence of new technologies. Furthermore, some specific terms may be randomly selected by the applicant, in which case the meanings of the terms may be specifically defined in the description of the exemplary embodiment. Thus, the terms should be defined not by simple appellations thereof but based on the meanings thereof and the context of the description of the exemplary embodiment. As used herein, expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

It will be understood that when the terms "includes," "comprises," "including," and/or "comprising," when used in this specification, specify the presence of stated elements and/or components, but do not preclude the presence or addition of one or more elements and/or components thereof. As used herein, the term "module" refers to a unit that can perform at least one function or operation and may be implemented utilizing any form of hardware, software, or a combination thereof.

FIG. **1** is a diagram illustrating an environment for fitting a hearing aid by using a positioning system such as at least one of a global system, a local positioning system, and a site-wide system according to one or more exemplary embodiments. A global system may be a global navigation satellite system (GNSS) that could be, for example, at least one of a Global Positioning System (GPS), Global Navigation Satellite System (GLONASS), Galileo, BeiDou Navigation Satellite Systems (BDS), Indian Regional Navigational Satellite System (IRNSS), and Quasi-Zenith Satellite System (QZSS). A site-wide system may include an indoor positioning system optimized for use within buildings, for example, a low-power wireless indoor location system using multiple ultrasonic receivers.

Further, a local positioning system may include the use of beacons with limited range which may include at least cellular base stations, Wi-Fi access points, radio towers, and/or land-based positioning transmitters that transmit to specialized receivers to determine a position such as the long range navigation (LORAN) system or Decca Navigator System. A local system may use any one of at least triangulation, trilateration, and/or multilateration (for example Observed Time Difference Of Arrival (OTDOA) as disclosed in rel9 E-UTRA LTE disclosures) to calculate a position of a user device and/or mobile terminal. Additionally, a local positioning system may be a mobile device tracking system such as, for example, Enhanced Cell ID (E-CEllID), as defined in the 3GPP standards, a Wi-Fi positioning system, or some other network-based or handset-based system. Some of the technologies that may be used may include at least time of flight systems, spatial scan systems, inertial sensing systems, phase difference systems, direct field sensing systems, and hybrid systems.

Referring to FIG. **1**, the environment for fitting a hearing aid by using a positioning system includes a mobile terminal **100**, which may also be called user equipment (UE), a server **200** and a hearing aid **300**. For convenience of explanation, only a single mobile terminal **100** and a single server **200** are illustrated in FIG. **1**. However, one or more exemplary embodiments are not limited thereto, and a plurality of mobile terminals may be connected to a plurality of servers.

While FIG. **1** illustrates only components related to an exemplary embodiment, it will be understood by one of ordinary skill in the art that other general-purpose components may be further included in the environment.

The mobile terminal **100** communicates with the server **200** and controls the hearing aid **300**. According to an exemplary embodiment, the mobile terminal **100** may provide location information, which is information about a user's location, to the server **200** through communication with the server **200**, and may receive a fitting parameter model from the server **200**. Also, the mobile terminal **100** controls the hearing aid **300** connected through searching to set a desired fitting parameter value into the hearing aid **300**.

Examples of the mobile terminal **100** may include a mobile phone, a smart phone, a notebook computer, a terminal for digital broadcasting, a personal digital assistant (PDA), a portable multimedia player (PMP), a navigation, a tablet personal computer (PC), etc. However, one or more exemplary embodiments are not limited thereto, and examples of the mobile terminal **100** include all mobile apparatus capable of communicating with the server **200** and controlling the hearing aid **300**. Details of a mobile terminal according to one or more embodiments are described below with reference to FIG. **2**.

The server **200** communicates with the mobile terminal **100**, and provides data stored in the server **200** or provides various services by using programs that are executed in the server **200**. In this case, the server **200** may be a cloud server **200** but is not limited thereto. According to the current exemplary embodiment, the server **200** receives location information of a user from the mobile terminal **100**, and provides a fitting parameter model determined based on the received location information of the user and hearing characteristics of the user to the mobile terminals **100**.

The server **200** stores fitting parameter models of the hearing aid **300**, which are mapped to each location, along with the hearing characteristics. In addition, the server **200** may further store situation information for the fitting parameter models, test sounds, and satisfaction evaluations. The server **200** may store a record and an error zone in which an abnormality in functionality of the hearing aid **330** has occurred, with respect to each location.

The mobile terminal **100** and the server **200** may transmit data to each other and receive data from each other through a wire or wireless network or wired serial communication by using their respective communication modules. Examples of the network may include the Internet, a local area network (LAN), a wireless LAN, a wide area network (WAN), and a personal area network (PAN). However, one or more exemplary embodiments are not limited thereto, and the network may be another type of network capable of transmitting and receiving information.

A hearing aid **300** is an apparatus for outputting sound that compensates for hearing loss so that a user can sufficiently hear a sound which the user cannot otherwise hear well due to the hearing loss. The hearing aid **300** outputs a sound that compensates for hearing loss of a user by detecting sounds around the user and adjusting the detected sounds according to fitting parameter values of the hearing aid **300**. The fitting parameter values of the hearing aid **300** may be set based on a fitting parameter model received from a server **200**, and may output a sound according to the set fitting parameter values.

A series of fitting parameter values set into the hearing aid **300** is referred to as a fitting parameter model. The fitting parameter values may be determined for each channel and for each frequency. The fitting parameter values are determined based on hearing characteristics of a user, and are values adjusted to output a sound for compensating for a hearing loss of a user.

The hearing characteristics of a user are data indicating whether the user can hear sounds within certain frequency bands and to which extent of loudness. The fitting parameter values are determined to be values minutely fitted based on the hearing characteristics and use an environment of a user so that the hearing aid **300** may output a sound for sufficiently compensating for the hearing loss of a user.

The mobile terminal **100** may search for the hearing aid **300** through paring and may then be connected to the searched hearing aid **300**. The mobile terminal **100** and the hearing aid **300** may be connected to each other through a local area network, such as Bluetooth, Radio Frequency Identification (RFID), Infrared Data Association (IrDA),

Ultra Wideband (UWB), ZigBee, or Wi-Fi Direct (WFD) Near Field Communication (NFC), by using their respective communication modules.

FIG. **2** is a diagram for explaining a method of providing a fitting parameter model corresponding to a location of each user from a server to each user's mobile terminal, according to an exemplary embodiment.

Users A, B, C, and D receive respective fitting parameter models from the server **200** by using a positioning system **110**.

For example, if the users A, B, and C are located in the same location, pieces of location information that are obtained by the respective mobile terminals of the users A, B, and C will be the same. If the users A and B have the same hearing characteristic and the user C has hearing characteristics that are different from those of the users A and B, the server **200** may transmit a same fitting parameter model #1 to the users A and B because the users A and B have the same location information and the same hearing characteristics. On the other hand, the user C may receive another fitting parameter model #2 from the server **200**.

In this case, if the user A feels uncomfortable about the received fitting parameter model #1, a fitting of the user A's hearing aid may be performed again by using a fitting program of the user A's mobile terminal and a fitting parameter model #3 obtained as a result of the fitting may be uploaded into the server **200**.

Accordingly, the user B may receive a more accurate fitting parameter model #3, which the user A having the same hearing characteristics as the user B has uploaded, from the server **200**, and may use the received fitting parameter model #3 instead of the previously received fitting parameter model #1.

According to another exemplary embodiment, the server **200** may compare the fitting parameter model #3 uploaded by the user A with a previous fitting parameter model and may analyze whether a sound of a low frequency band is not heard well in a region. In addition, based on the analysis result, the server **200** may generate a fitting parameter model #4 that is obtained by modifying the intensity of the sound of the low frequency band in the fitting parameter model #2 stored in the server **200**, and may provide the fitting parameter model #4 to the user C.

As in the above exemplary embodiments, users may register fitting parameter models optimized with respect to location characteristics of a region and hearing characteristics of the users to the server **200** by using the positioning system, and may be provided with the registered fitting parameter model from the server **200**.

For example, if the region is a baseball stadium, the server **200** may provide a fitting parameter model, in which location characteristics of the baseball stadium are considered, to a user's terminal. Alternatively, if the region is a concert hall, the server **200** may provide a fitting parameter model, in which location characteristics of the concert hall are considered, to a user's terminal.

Accordingly, a fitting parameter model, in which location characteristics of the region are considered, may be shared with other users through the server **200**.

In another exemplary embodiment, if the user D is located in a region, which is different from regions in which the users A, B, and C are located, and ascertains that the user D's hearing aid does not correctly operate in the region, the user D may transmit location information of the region to the server **200** by using the user D's mobile terminal. The server **200** may register a region, in which an abnormality of the user D's hearing aid has occurred, as an error zone based on the information received from the user D. Accordingly, when the users A, B, and C enter into the current location of the user D, the server **200** may transmit a message warning that the current location corresponds to the error zone to terminals of the users A, B, and C.

In another exemplary embodiment, by operating different servers **200** and **300** for each hearing aid maker, a fitting parameter model that is most suitable for characteristics of a user's hearing aid may be provided to the user.

However, exemplary embodiments relating a method of fitting a hearing aid connected to a mobile terminal, a mobile terminal for performing the method, and a related recording medium are not limited to the exemplary embodiments described with reference to FIG. **2**.

FIG. **3** is a block diagram of a mobile terminal **100** according to an exemplary embodiment. Referring to FIG. **3**, the mobile terminal **100** may include a positioning system **110**, a communication interface unit **120**, a setting unit **130**, a processor **140**, a user interface unit **150**, and a memory **160**. The mobile terminal **100** may further include a situation information acquisition unit **170** for acquiring situation information of a user and/or a movement information acquisition unit **180** for acquiring movement information of a user.

The positioning system **110** acquires location information of the mobile terminal **100**, which is information about the location of the mobile terminal **100**. According to an exemplary embodiment, the positioning system **110** may be a system that accurately measures the location of an object by using a plurality of satellites, such as GPS. The location information that is acquired by the positioning system **110** may have latitude, longitude, altitude, velocity, azimuth, etc. According to the current exemplary embodiment, the positioning system **110** may acquire the location information in a form of coordinates including the latitude, the longitude, and the altitude, and the mobile terminal **100** may transmit the location information acquired in the form of coordinates to the server **200**. However, one or more exemplary embodiments are not limited thereto. That is, the positioning system **110** may further use other information, which may be acquired by using a satellite system of the positioning system **110**, as the location information.

The communication interface unit **120** transmits location information of a user of the mobile terminal **100** to the server **200**. The mobile terminal **100** may further transmit hearing characteristics of the user, situation information of the user, or movement information of the user other than the location information of the user to the server **200**. In this regard, details are described with reference to FIGS. **8** through **11**.

According to another exemplary embodiment, the communication interface unit **120** may transmit hearing characteristics of the user or authentication information of the user to the server **200**. For example, the server **200** may receive the hearing characteristics of the user or the authentication information of the user directly from the mobile terminal **100** or via another server. In this regard, details are described with reference to FIG. **6**C.

According to another exemplary embodiment, a communication interface unit **120** may further transmit feedback indicating an evaluation of satisfaction with a fitting parameter model to a server **200**. Alternatively, after performing a fitting of a hearing aid **300** in a mobile terminal **100**, the communication interface unit **120** may upload information about a location at which the fitting has been performed and an obtained fitting parameter model into the server **200**. In

this case, the communication interface unit **120** may further upload information about the situation when fitting into the server **200**.

In addition, the communication interface unit **120** may receive information about a fitting parameter model or a recommended fitting parameter model from the server **200**. In another exemplary embodiment, a communication interface unit **120** may further receive a message informing a user that there is a recommended fitting parameter model, which corresponds to the location information of the user and the hearing characteristics of the user, or a warning message informing a user of an error zone in which an abnormality of a hearing aid has occurred, from a server **200**.

The communication interface unit **120** may transmit or receive data through a wire or wireless network or a wire serial communication. Examples of the network may include the Internet, a local area network (LAN), a wireless LAN, a wide area network (WAN), and a personal area network (PAN). However, one or more exemplary embodiments are not limited thereto, and the network may be another type of network capable of transmitting and receiving information.

The communication interface unit **120** may search the hearing aid **300** and may connect the communication interface unit **120** to the searched hearing aid **300**. The communication interface unit **120** may be connected to the hearing aid **300** by using a LAN technology. Examples of the LAN technology include Bluetooth, radio frequency identification (RFID), infrared data association (IrDA), ultra-wideband (UWB), ZigBee, or Wi-Fi Direct (WFD) near field communication (NFC), etc.

A setting unit **130** may set a received fitting parameter model into the hearing aid **300** connected to the setting unit **130** so that the hearing aid is configured to operate according to the fitting parameter model. Accordingly, the hearing aid **300** connected to the mobile terminal **100** may output a sound adjusted according to the set fitting parameter model.

The setting unit **130** may be at least one processor or may be included in the processor **140**. Accordingly, the setting unit **130** and the processor **140** may operate as separate processors as illustrated in FIG. **3** or may operate as a single processor in a form in which the setting unit **130** is included in the processor **140**.

The processor **140** controls the communication interface unit **120** to be operated according to a set fitting mode of the mobile terminal **100**. Accordingly, when the received fitting mode is the manual mode, the processor **140** may determine to receive information about a recommended fitting parameter model of the hearing aid **300** from the server **200** in advance to receive a fitting parameter model from the server **200**.

The processor **140** may control the communication interface unit **120** to be operated according to the on/off setting of an informing mode in the mobile terminal **100**. Accordingly, the processor **140** may determine whether to receive information about a recommended fitting parameter model according to the setting of the informing mode.

The processor **140** may determine whether to automatically change the presently set fitting parameter model of the hearing aid **300** in an automatic fitting mode. In this regard, details are described with reference to FIGS. **8** through **11**.

In addition, the processor **140** may control the overall operation of the mobile terminal **100**. For example, the processor **140** performs the communication with the server **200**, the control of the hearing aid **300**, the control and processing related to data communication and voice calls. That is, the processor **140** may overall control the communication interface unit **120**, the setting unit **130**, the user interface unit **150**, the memory **160**, the situation information acquisition unit **170**, and the movement information acquisition unit **180**.

The user interface unit **150** may receive input information input by a user, and display output information processed in the mobile terminal **100** to the user. For example, the user interface unit **150** may include an input device such as a key pad, a dome switch, a pressure sensitive touch pad or capacitive touch pad, a jog wheel, a jog switch, or a hardware button, an output device such as a touch screen, a liquid crystal display, a thin film transistor-liquid crystal display, an organic light-emitting diode, a flexible display, or a three-dimensional display, and a software module for driving the input device and the output device. In addition, the user interface unit **150** may be implemented with a touch screen having a form in which an input device and an output device are combined with each other.

The user interface unit **150** may receive a fitting mode which is input from the user between a manual fitting mode and an automatic fitting mode. The user interface unit **150** may receive an informing mode which is input from the user between an informing on mode and an informing off mode.

The user interface unit **150** may display at least one fitting parameter model and receive a selection of the user of any one fitting parameter model from among the at least one fitting parameter model that is displayed.

The memory **160** is a general storage medium, and may store data such as fitting parameter models and hearing characteristics of a user and/or programs such as a fitting program for fitting a hearing aid and obtaining fitting parameter values of a hearing aid. The memory **160** may be implemented with a hard disk drive (HDD), a read only memory (ROM), a random access memory (RAM), a flash memory, a memory card, or a solid state drive (SSD).

The situation information acquisition unit **170** may acquire situation information from a user. The situation information may indicate information about the surroundings, occasion, and situation of the user. The situation information may be acquired through a microphone **172** or camera **171** of the mobile terminal **100**, or may be transmitted to the mobile terminal **100** after being acquired through a microphone (not shown) on the hearing aid **300**.

The camera **171** may acquire situation information from a user in a form of a still image or video. The camera **171** may include a photographing apparatus for capturing an image and an image sensor module for processing a captured image frame such as a still image or video.

The microphone **172** may acquire situation information from a user in a form of electrical voice data obtained by processing an external acoustic signal acquired by a microphone. The microphone **172** may include the microphone for acquiring an external sound as well as a digital signal processing module for removing noises and processing signals.

When acquiring the situation information from a user by using a microphone of the hearing aid **300**, a sound obtained at the left side of the user and a sound obtained at the right side of the user may be separately obtained by using binaural hearing aids.

The movement information acquisition unit **180** may acquire movement information from a user. The movement information is information related to the movement of a user, such as a moving speed, a moving distance, and a moving direction of a user. The movement information may be acquired by an acceleration sensor **181** or a geomagnetic sensor **182** of the mobile terminal **100**.

The acceleration sensor **181** may sense a movement state or a motional state of a user of the mobile terminal **100** by sensing a vibration or an impact applied to the mobile terminal **100** or a change in the speed of the mobile terminal **100**.

The geomagnetic sensor **182** may recognize the movement or the location of an object by using geomagnetism.

FIG. **4** is a flowchart illustrating a method of fitting a hearing aid by using a positioning system in a mobile terminal, according to an exemplary embodiment. The method illustrated in FIG. **4** includes operations that are time-sequentially processed in the mobile terminal **100** illustrated in FIGS. **1** through **3**. Accordingly, although omitted below, details described above with respect to the mobile terminal **100** illustrated in FIGS. **1** through **3** may be applied to the method illustrated in FIG. **4**.

In operation **410**, the positioning system **110** acquires location information which is about the location of a user. The location information that is acquired by the positioning system **110** may have latitude, longitude, altitude, velocity, azimuth, etc. According to the current embodiment, the positioning system **110** may acquire the location information in a form of coordinates including the latitude, the longitude, and the altitude.

In operation **420**, the communication interface unit **120** transmits the location information of the user to the server **200**. The mobile terminal **100** may further transmit hearing characteristics of the user, situation information of the user, or movement information of the user other than the location information of the user to the server **200**. In this regard, details are described with reference to FIGS. **8** through **11**.

In operation **430**, the processor **140** determines whether a fitting mode set into the mobile terminal **100** is an automatic fitting mode or a manual fitting mode. The fitting mode indicates whether to automatically change a fitting parameter model of the hearing aid **300** according to the location of the user. Accordingly, if the fitting mode set into the mobile terminal **100** is the automatic fitting mode, the method proceeds to operation **340**. If the fitting mode set into the mobile terminal **100** is the manual fitting mode, the method proceeds to operation **370**.

In operation **440**, the communication interface unit **120** receives a fitting parameter model determined based on location information about the current location of the user and hearing characteristics of the user from the server **200**. The server **200** may store fitting parameter models of the hearing aid **300**, which are mapped to each location, along with the hearing characteristics. According to another exemplary embodiment, the server **200** may store the fitting parameter models along with situation information or satisfaction evaluation other than the hearing characteristics. In this regard, details are described with reference to FIGS. **8** through **20** below.

In operation **450**, the setting unit **130** sets the fitting parameter model received by the communication interface unit **120** into the connected hearing aid **300**.

In the automatic fitting mode, as described above, the fitting parameter model of the hearing aid **300** is automatically changed according to the location of the user.

In operation **460**, the communication interface unit **120** receives a message informing the user that there is a recommended fitting parameter model, from the server **200**.

In operation **470**, the user interface unit **150** displays the received message.

In the manual fitting mode, the intervention of the user is required to set or change the fitting parameter model of the hearing aid **300**.

FIG. **5** is a diagram illustrating a screen for setting a fitting mode in a mobile terminal, according to an exemplary embodiment.

A screen **510** is an example of a user interface screen through which a user may set any one of the manual fitting mode and the automatic fitting mode of the hearing aid **300**. The screen **510** shows a case in which the automatic fitting mode is set by the current user.

The fitting mode may indicate whether to automatically change a fitting parameter model of the hearing aid **300** according to the location of the user. That is, in the automatic fitting mode, the fitting parameter model is automatically changed according to the location information of the user. In the manual fitting mode, the user selects whether to change the fitting parameter model and personally selects a fitting parameter model to be changed.

In detail, in the automatic fitting mode, the mobile terminal **100** receives a fitting parameter model corresponding to location information of the user from the server **200** according to the location of the user and automatically sets the received fitting parameter model into the hearing aid **300**, and thus, the fitting parameter model of the hearing aid **300** may be automatically changed according to the location of the user.

In the manual fitting mode, the user personally selects one of fitting parameter models, which is displayed by the mobile terminal **100**, and requests the mobile terminal **100** to apply the selected fitting parameter model to the hearing aid **300**. Then, a previously set fitting parameter model of the hearing aid **300** is replaced with the selected fitting parameter model. In the manual fitting mode, an informing on mode or an informing off mode may be further set.

The screen **520** is an example of a user interface screen in which a user may set any one of the informing "on" mode and the informing "off" mode in the manual fitting mode. The screen **520** shows a case in which the informing "on" mode of the manual fitting mode is set by the current user.

The informing mode indicates whether to receive a message, which informs the user that there is a recommended fitting parameter model corresponding to the location information of the user and hearing characteristics of the user, from the server **200**. That is, in the informing "on" mode, according to the location of the user, the mobile terminal **100** receives the message informing the user that there is a recommended fitting parameter model corresponding to the location information of the user and the hearing characteristics of the user, and displays the received message.

In detail, in the informing "on" mode, the mobile terminal **100** receives information about the recommended fitting parameter model from the server **200**, and the user may select one fitting parameter model based on the received information about the recommended fitting parameter model. In addition, the mobile terminal **100** may receive the fitting parameter model selected by the user and may set the received fitting parameter model into the hearing aid **300**, and thus, a previously set fitting parameter model of the hearing aid **300** may be replaced with the fitting parameter model selected by the user.

In the informing "off" mode, without receiving a message or a fitting parameter model from the server **200**, the user may select one of fitting parameter models previously stored in the memory **160** and sets the selected fitting parameter model into the hearing aid **300**, and thus, a previously set fitting parameter model of the hearing aid **300** may be replaced with the selected fitting parameter model.

FIGS. **6**A through **6**C illustrate exemplary embodiments of methods that may be performed when the automatic fitting mode is set as shown in the flowchart illustrated in FIG. **4**.

FIG. **6**A is a flowchart illustrating a method of automatically fitting a hearing aid **300** by using a positioning system in a mobile terminal **100**, according to an exemplary embodiment.

In operation **602**, the mobile terminal **100** requests a connection from the hearing aid **300**. In detail, the mobile terminal **100** may search for the hearing aid **300** and may request the searched hearing aid **300** to establish a connection to the mobile terminal **100**.

In operation **604**, the hearing aid **300** is connected to the mobile terminal **100**. Thus, the hearing aid **300** may pair with the mobile terminal **100**. The mobile terminal **100** may search for the hearing aid **300** by using a LAN technology such as Bluetooth and may be connected to the searched hearing aid **300**.

If the mobile terminal **100** and the hearing aid **300** are connected to each other once, the connection state is maintained as far as no special situation such as a turning off of a power supply happens, and thus, the operations **602** and **604** may be performed in advance. Thus, the following exemplary embodiments are described under the assumption that the mobile terminal **100** and the hearing aid **300** were connected to each other.

In operation **610**, the mobile terminal **100** acquires location information of a user by using the positioning system **110**.

In operation **620**, the mobile terminal **100** transmits the location information of the user to a server **200**.

In operation **630**, the server **200** determines a fitting parameter model based on the received location information of the user and hearing characteristics of the user. The server **200** may store fitting parameter models of the hearing aid **300**, which are mapped to each location, along with hearing characteristics of the user in a form of database. The server **200** may determine a fitting parameter model more suitable for the user based on location information and hearing characteristics of the user, which are stored in the form of database.

The hearing characteristics of the user may be transmitted from the mobile terminal **100** to the server **200**. An exemplary embodiment related to this is described with reference to FIG. **6**B. Alternatively, the hearing characteristics of the user may be transmitted from a server (i.e., a second server) that is different from the server **200** to the server **200**. An exemplary embodiment related to this is described with reference to FIG. **6**C.

In operation **640**, the server **200** transmits the determined fitting parameter model to the mobile terminal **100**.

In operation **650**, the mobile terminal **100** set the fitting parameter model received from the server **200** into the connected hearing aid **300**.

In operation **660**, the hearing aid **300** operates according to the set fitting parameter model. Accordingly, the hearing aid **300** may output a sound adjusted according to the set fitting parameter model.

FIG. **6**B is a flowchart illustrating a method of automatically fitting a hearing aid **300** by using a positioning system in a mobile terminal **100**, according to another exemplary embodiment. FIG. **6**B illustrates a case in which the mobile terminal **100** transmits hearing characteristics of a user as well as location information of the user to a server **200**.

In operation **610**, the mobile terminal **100** acquires location information of a user by using the positioning system **110**.

In operation **620**, the mobile terminal **100** transmits the location information of the user and hearing characteristics of the user to the server **200**.

In operation **630**, the server **200** determines a fitting parameter model based on the received location information of the user and the received hearing characteristics of the user. The server **200** may store fitting parameter models of the hearing aid **300**, which are mapped to each location, along with hearing characteristics of the user in a form of database. The server **200** may determine a fitting parameter model more suitable for the user based on location information and hearing characteristics of the user, which are stored in the form of database.

In operation **640**, the server **200** transmits the determined fitting parameter model to the mobile terminal **100**.

In operation **650**, the mobile terminal **100** set the fitting parameter model received from the server **200** into the connected hearing aid **300**.

In operation **660**, the hearing aid **300** operates according to the set fitting parameter model. Accordingly, the hearing aid **300** may output a sound adjusted according to the set fitting parameter model.

FIG. **6**C is a flowchart illustrating a method of automatically fitting a hearing aid **300** by using a positioning system in a mobile terminal **100**, according to another exemplary embodiment. FIG. **6**C illustrates a case in which the mobile terminal **100** transmits hearing characteristics of a user to a server **200**, i.e., a first server, by using a second server **210** that is different from the first server **200**.

In operation **610**, the mobile terminal **100** acquires location information of a user by using the positioning system **110**.

In operation **622**, the mobile terminal **100** transmits the location information of the user to the first server **200**.

In operation **624**, the mobile terminal **100** transmits authentication information of the user to the second server **210**. In the current exemplary embodiment, hearing characteristics of the user is not directly transmitted from the mobile terminal **100** to the first server **200**, but is transmitted to the first server **200** via the second server **210**.

In operation **626**, the second server **210** acquires the hearing characteristics of the user by using the authentication information of the user. That is, the second server **210** receives the authentication information of the user, and acquires the hearing characteristics of the user based on the received authentication information of the user. The authentication information of the user may be an identification (ID) or password (PW) of the user, but is not limited thereto.

In operation **628**, the second server **210** transmits the hearing characteristics of the user to the first server **200**.

In operation **630**, the first server **200** determines a fitting parameter model based on the received location information of the user and the received hearing characteristics of the user. The first server **200** may store fitting parameter models of the hearing aid **300**, which are mapped to each location, along with hearing characteristics of the user in a form of database. The first server **200** may determine a fitting parameter model more suitable for the user based on location information and hearing characteristics of the user, which are stored in the form of database.

In operation **640**, the first server **200** transmits the determined fitting parameter model to the mobile terminal **100**.

In operation **650**, the mobile terminal **100** may set the fitting parameter model received from the first server **200** into the connected hearing aid **300**.

In operation **660**, the hearing aid **300** operates according to the set fitting parameter model. Accordingly, the hearing aid **300** may output a sound adjusted according to the set fitting parameter model.

According to the current embodiment, the hearing characteristics of the user and the location information of the user are separately managed by two servers, that is, the first server **200** and the second server **210**, thereby maintaining the privacy of the user.

FIG. **7** is a flowchart illustrating a method of automatically fitting a hearing aid **300** by using a positioning system in a mobile terminal **100**, according to another exemplary embodiment. Comparing with the methods of FIGS. **6**A through **6**C, in the method of FIG. **7**, the mobile terminal **100** additionally transmits situation information of a user to a server **200** and the server **200** provides a fitting parameter model determined by further referring to the situation information of the user.

In operation **711**, the mobile terminal **100** acquires location information of a user by using the positioning system **110**.

In operation **712**, the mobile terminal **100** transmits the location information of the user to a server **200**.

In operation **713**, the mobile terminal **100** acquires situation information of the user. The situation information may indicate at least at least information about the surroundings, occasion, time, and situation of the user. The situation information may be acquired from a storage medium or through a sensor such as a microphone **172** or camera **171** of the mobile terminal **100**, or may be transmitted to the mobile terminal **100** after being acquired through a microphone (not shown) of the hearing aid **300**.

In operation **714**, the mobile terminal **100** transmits the situation information of the user to a server **200**.

In operation **715**, the server **200** determines a fitting parameter model based on the location information of the user, the situation information of the user, and hearing characteristics of the user.

The server **200** may store fitting parameter models of the hearing aid **300**, which are mapped to each location, along with the hearing characteristics of the user and the situation information of the user. Accordingly, the server **200** may provide a fitting parameter model more suitable for location characteristics, surroundings, and situation of the user by further referring to the situation information of the user.

For example, if a user sequentially listens to a musical performance and a lecture in the same little theater, situation information of the user is changed with a time interval while location information of the user is not changed.

For comparison, in the methods of FIGS. **6**A through **6**C, the mobile terminal **100** may transmit location information of a little theater to the server **200**. The server **200** may determine one of fitting parameter models suitable for the hearing characteristics of the user from among fitting parameter models suitably fitted for location characteristics of the little theater according to the location information of the little theater, and may provide the determined fitting parameter model to the user. However, because characteristics of sounds that are generated in the musical performance are different from those that are generated in the lecture, fitting parameter models more suitable for respective situations may be different from each other.

On the other hand, in the method of FIG. **7**, when the mobile terminal **100** acquires situation information of a user by using a microphone or a camera and transmits the acquired situation information to the server **200**, the server **200** may provide a fitting parameter model more suitable for the current situation of the user to the user, even with respect to the same location information.

In operation **716**, the server **200** transmits a determined fitting parameter model to the mobile terminal **100**.

In operation **717**, the mobile terminal **100** sets the fitting parameter model received from the server **200** into the hearing aid **300**.

In operation **718**, the hearing aid **300** operates according to the set fitting parameter model.

FIGS. **8** through **11** are flowcharts illustrating methods of determining whether the processor **140** automatically changes the currently set fitting parameter model of the hearing aid **300** in the automatic fitting mode of the mobile terminal **100** according to one or more exemplary embodiments. In the automatic fitting mode of the mobile terminal **100**, a fitting parameter model of the hearing aid **300**, which is set according to the location of a user, is automatically changed. However, according to another exemplary embodiment, there is a case in which it is not necessary to change the currently set fitting parameter model of the hearing aid **300**. Thus, this case may be designated in advance and control of the fitting parameter model of the hearing aid **300** may be controlled so that the fitting parameter is not to be automatically changed. Detailed exemplary embodiments related to this case are described with reference to FIGS. **8** through **11**.

FIG. **8** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of the hearing aid **300** based on movement information of a user in the automatic fitting mode of the mobile terminal **100**, according to an exemplary embodiment. Operations **830** and **840** illustrated in FIG. **8** are similar to operations **440** and **450** illustrated in FIG. **4**, and thus, descriptions thereof are not repeated.

In operation **810**, the movement information acquisition unit **180** acquires movement information of a user. The movement information is information related to the movement of a user, such as a moving speed, a moving distance, and a moving direction of a user. The movement information may be acquired by the acceleration sensor **181**, the geomagnetic sensor **182**, or the positioning system **110** of the mobile terminal **100**.

In operation **820**, the processor **140** determines whether to change the currently set fitting parameter model of the hearing aid **300** based on the movement information of the user in the automatic fitting mode of the mobile terminal **100**. If the processor **140** determines to change the currently set fitting parameter model based on the movement information of the user, the method proceeds to operation **830**. If the processor **140** determines not to change the currently set fitting parameter model, the processor **140** controls the hearing aid **300** so as to maintain the fitting parameter model currently set into hearing aid **300**.

For example, the processor **140** may determine not to change the currently set fitting parameter model of the hearing aid **300** based on a moving distance or a moving speed of a user. Detailed embodiments related to this case are described with reference to FIGS. **9** and **10**.

In operation **830**, the communication interface unit **120** receives a fitting parameter model, which corresponds to current location information of the user and hearing characteristics of the user, from the server **200**.

In operation **840**, the setting unit **130** sets the fitting parameter model received by the communication interface unit **120** into the connected hearing aid **300**.

FIG. **9** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of the hearing aid **300** based on movement information of a user in the automatic fitting mode of the mobile terminal **100**, according to another exemplary embodiment. Operations **930** and **940** illustrated in FIG. **9** are similar to operations **440** and **450** illustrated in FIG. **4**, and thus, descriptions thereof are not repeated.

In operation **910**, the movement information acquisition unit **180** acquires movement information of a user. In this case, the acquired movement information includes a moving distance of the user.

In operation **920**, the processor **140** determines whether to change the currently set fitting parameter model of the hearing aid **300** based on the moving distance of the user in the automatic fitting mode. In this case, if the moving distance is equal to or less than a predetermined distance, it is determined that the currently set fitting parameter model needs not to be changed.

That is, if moving distances of the user are relatively not long, fitting parameter models corresponding to location information of the user are the same as or very similar to each other. Thus, the mobile terminal **100** needs not to receive a new fitting parameter model from the server **200** and needs not to reset the hearing aid **300**. Accordingly, the processor **140** controls the hearing aid **300** so as to maintain the fitting parameter model currently set into the hearing aid **300**.

On the contrary, if a moving distance of the user exceeds a predetermined distance, it is determined that the currently set fitting parameter model of the hearing aid **300** needs to be changed. Accordingly, the method proceeds to operation **930**.

In operation **930**, the communication interface unit **120** may receive a fitting parameter model, which corresponds to current location information of the user and hearing characteristics of the user, from the server **200**.

In operation **940**, the setting unit **130** may set the fitting parameter model received by the communication interface unit **120** into the connected hearing aid **300**.

FIG. **10** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of the hearing aid **300** based on movement information of a user in the automatic fitting mode of the mobile terminal **100**, according to another exemplary embodiment. Operations **1030** and **1040** illustrated in FIG. **10** are similar to operations **440** and **450** illustrated in FIG. **4**, and thus, descriptions thereof are not repeated.

In operation **1010**, the movement information acquisition unit **180** acquires movement information of a user. In this case, the acquired movement information includes a moving speed of the user.

In operation **1020**, the processor **140** determines whether to change the currently set fitting parameter model of the hearing aid **300** based on the moving speed of the user in the automatic fitting mode. In this case, if the moving speed is equal to or greater than a predetermined speed, it is determined that the currently set fitting parameter model needs not to be changed.

If the moving speed of the user is very fast, for example, the user is moving with a vehicle, acquired location information of the user corresponds to a point by which the user passes. Thus, the mobile terminal **100** may not need to receive a new fitting parameter model from the server **200** and may not need to reset the hearing aid **300**. Accordingly, the processor **140** controls the hearing aid **300** so as to maintain the fitting parameter model currently set into the hearing aid **300**.

If a moving speed of the user is less than a predetermined speed, it is determined that the currently set fitting parameter model of the hearing aid **300** needs to be changed. Accordingly, the method proceeds to operation **1030**.

In operation **1030**, the communication interface unit **120** receives a fitting parameter model, which corresponds to current location information of the user and hearing characteristics of the user, from the server **200**.

In operation **1040**, the setting unit **130** sets the fitting parameter model received by the communication interface unit **120** into the connected hearing aid **300**.

FIG. **11** is a flowchart illustrating a method of determining whether to change the currently set fitting parameter model of the hearing aid **300** based on situation information of a user in the automatic fitting mode of the mobile terminal **100**, according to another exemplary embodiment. Operations **1130** and **1140** illustrated in FIG. **11** are similar to operations **440** and **450** illustrated in FIG. **4**, and thus, descriptions thereof are not repeated.

In operation **1110**, the situation information acquisition unit **170** acquires situation information of a user. In this case, the situation information may indicate information about the surroundings, occasion, time, and situation of the user, which are determined based on a sound or scene around the user when fitting the hearing aid **300**. The situation information may be acquired through the microphone of the hearing aid **300** and the microphone **172** or the camera **117** of the mobile terminal **100**.

In operation **1120**, the processor **140** determines whether to change the currently set fitting parameter model of the hearing aid **300** based on the situation information of the user in the automatic fitting mode of the mobile terminal **100**. If it is determined that the processor **140** needs to change the currently set fitting parameter model based on the situation information of the user, the method proceeds to operation **1130**. If it is determined that the processor **140** does not need to change the currently set fitting parameter model, the processor **140** controls the hearing aid **300** so as to maintain the fitting parameter model currently set into hearing aid **300**.

For example, the processor **140** may determine not to change the currently set fitting parameter model of the hearing aid **300** if it is determined that the user is on the phone or is exercising, based on the situation information of the user.

In operation **1130**, the communication interface unit **120** receives a fitting parameter model, which corresponds to current location information of the user and hearing characteristics of the user, from the server **200**.

In operation **1140**, the setting unit **130** sets the fitting parameter model received by the communication interface unit **120** into the connected hearing aid **300**.

Although in the current exemplary embodiment, determining whether to change the currently set fitting parameter model of the hearing aid **300** based on only the situation information of the user in the automatic fitting mode is described, the processor **140** may determine whether to change the currently set fitting parameter model of the hearing aid **300** in consideration of both of the situation information of the user and the movement information of the user

FIG. **12** is a flowchart illustrating a method of informing a user of a hearing aid of an error zone by using a positioning

system in a mobile terminal **100**, according to an exemplary embodiment. Operations **1210** and **1220** illustrated in FIG. **12** are similar to operations **711** and **712** illustrated in FIG. **7**, and thus, descriptions thereof are not repeated.

In operation **1210**, the mobile terminal **100** acquires location information of a user by using the positioning system **110**.

In operation **1220**, the mobile terminal **100** transmits the location information of the user to a server **200**.

In operation **1230**, the server **200** determines whether the location information of the user corresponds to an error zone registered in the server **200**. The error zone is a zone where an abnormality of the hearing aid has occurred. The server **200** stores records about the occurrence of the abnormality of the hearing aid with respect to each location, and registers error zones based on the records.

In operation **1240**, if the server **200** determines that the location information of the user corresponds to an error zone registered in the server **200**, the server **200** transmits a warning message, which informs the mobile terminal **100** of the error zone, to the mobile terminal **100**. Accordingly, because the user may perceive, in advance, that the location of the user is the error zone, a risk that may occur due to the abnormality of the hearing aid may be prevented beforehand.

FIG. **13** is a flowchart illustrating a method of registering an error zone, in which an abnormality of the hearing aid **300** has occurred, at a server **200** by using a positioning system in a mobile terminal **100**, according to an exemplary embodiment.

In operation **1310**, the mobile terminal **100** receives a signal indicating the occurrence of an abnormality of the hearing aid **300**. That is, a user perceives that an abnormality of the hearing aid **300** has occurred and inputs a signal indicating the occurrence of the abnormality through the user interface unit **150**. The abnormality of the hearing aid **300** indicates that the hearing aid **300** does not normally operate due to jamming or the like.

In operation **1320**, the mobile terminal **100** acquires location information about a location, at which the abnormality of the hearing aid **300** has occurred, by using a positioning system **110**.

In operation **1330**, the mobile terminal **100** transmits the location information to the server **200**.

In operation **1340**, the server **200** registers the location, in which the abnormality of the hearing aid **300** has occurred, as an error zone. The server **200** may collect location information about the location of a place, in which an abnormality of the hearing aid **300** has occurred, from the user, may compile statistics of the location information, and then may register the place as an error zone if it is statistically determined that the abnormality of the hearing aid **300** is not a temporary abnormality.

In this manner, location information about an abnormality of the hearing aid **300**, which occurs due to location characteristics of a location, may be registered into the server **200** in advance by using the positioning system **110** and the user may be informed of the location information, and thus, a risk that may be encountered by a user may be prevented beforehand.

FIG. **14** is a flowchart illustrating a method of manually fitting a hearing aid by using a positioning system in a mobile terminal, according to another exemplary embodiment. Operations **1411** and **1412** illustrated in FIG. **14** are similar to operations **410** and **420** illustrated in FIG. **4**, and thus, descriptions thereof are not repeated.

In operation **1411**, the positioning system **110** acquires location information of a user.

In operation **1412**, the communication interface unit **120** transmits the location information of the user to the server **200**.

In operation **1413**, the processor **140** determines whether an informing mode set by the user in a manual fitting mode is turned on or off. If the informing mode set in the mobile terminal **100** is on, the method proceeds to operation **1414**. If the informing mode set in the mobile terminal **100** is off, the method proceeds to operation **1419**.

In operation **1414**, the communication interface unit **120** receives information about a recommended fitting parameter model from the server **200**. The recommended fitting parameter model is at least one fitting parameter model corresponding to hearing characteristics of a user from among fitting parameter models mapped to the location of the user. The information about the recommended fitting parameter model includes simple information related to the recommended fitting parameter model. The information about the recommended fitting parameter model may be a message informing a user that there is at least one recommended fitting parameter model corresponding to location information of a user and hearing characteristics of the user. The information about the recommended fitting parameter model may include the evaluation of user satisfaction with a fitting parameter model. In this regard, details are described with reference to FIG. **20**.

In operation **1415**, the user interface unit **150** displays the information about the recommended fitting parameter model received from the server **200**. In this regard, details are described with reference to a screen **1520** of FIG. **20**.

In operation **1416**, the user interface unit **150** receives a selection of the user. The user may select any one of displayed fitting parameter models, and inputs the selection of the user to the user interface unit **150**.

In operation **1417**, the communication interface unit **120** receives a fitting parameter model selected by the user from the server **200**.

In operation **1418**, the setting unit **130** sets the received fitting parameter model into the hearing aid **300**.

In a manual fitting mode in which the informing mode is turned on, the mobile terminal **100** receives information about recommended fitting parameter model from the server **200**, selects one of recommended fitting parameter models based on the received information, and then receives the selected fitting parameter model from the server **200**.

Below operations are operations that are performed in a manual fitting mode in which the informing mode is turned off.

In operations **1419**, the user interface unit **150** displays a fitting parameter model stored in the memory **160**. In this regard, details are described with reference to a screen **1510** of FIG. **15**.

In operation **1420**, the communication interface unit **120** receives a selection of the user. The user selects any one of displayed fitting parameter models, and inputs the selection of the user to the user interface unit **150**. If the selection of the user is input to the user interface unit **150**, the method proceeds to operation **1417** and the selected fitting parameter model is set into the hearing aid **300**.

In this manner, if the informing mode is turned off, the mobile terminal **100** does not receive information about a recommended fitting parameter model from the server **200** and sets the hearing aid **300** by using a fitting parameter model stored in the memory **160**.

FIG. **15** illustrates screens **1510** and **1520** for setting a fitting parameter model in a manual fitting mode of the mobile terminal **100**, according to an exemplary embodiment.

The screen **1510** illustrates an example in which the mobile terminal **100** may provide a fitting parameter model when turning off an informing mode indicating that there is a recommended fitting parameter model, in the manual fitting mode.

When a fitting mode set by a user in the mobile terminal **100** is the manual fitting mode, the processor **140** determines not to receive a fitting parameter model from the server **200**. In addition, in the manual fitting mode of the mobile terminal, when the user turns off the informing mode, the processor **140** determines not to receive information about a recommended fitting parameter model from the server **200**.

When the informing mode is turned off in the manual fitting mode of the mobile terminal **100**, the mobile terminal **100** displays a fitting parameter model stored in the memory **160** through the user interface unit **150**. Fitting parameter models stored in the memory **160** may be displayed as shown in the screen **1510**. For example, if the number of fitting parameter models stored in the memory **160** is nine, the mobile terminal **100** may display the fitting parameter models by using respective corresponding numbers as shown in the screen **1510**.

The mobile terminal **100** may receive any one of the fitting parameter models stored in the memory **160** from the user through the user interface unit **150**. For example, the user may select a number of a fitting parameter model which the user desires to set from among nine numbers displayed on the screen **1510**, and may input the selected number through the user interface **150**.

When a fitting parameter model is input, that is, a selected number is input, the setting unit **130** of the mobile terminal **100** sets the input fitting parameter model into the hearing aid **300** connected to the mobile terminal **100**. In this manner, the mobile terminal **100** may easily fit the hearing aid **100** with a desired fitting model.

The screen **1520** illustrates an example in which the mobile terminal **100** receives information about a recommended fitting parameter model from the server **200** when turning on the informing mode in the manual fitting mode.

When a fitting mode set by a user in the mobile terminal **100** is the manual fitting mode, the processor **140** receives a fitting parameter model from the server **200** and determines not to automatically set the fitting parameter model into the hearing aid **300**. In this case, when the user turns on the informing mode, the processor **140** determines to receive information about at least one recommended fitting parameter model from the server **200**.

When the informing mode is turned on in the manual fitting mode of the mobile terminal **100**, the mobile terminal **100** receives information about a recommended fitting parameter model, which corresponds to location information of the user and hearing characteristics of the user, from the server **200** through the communication interface unit **120**.

The user interface unit **150** displays the received information about the recommended fitting parameter model. The information about the recommended fitting parameter model may be displayed as shown in the screen **1520**. For example, when the number of recommended fitting parameter models searched in the server **200** is three, the mobile terminal **100** may show that there are three recommended parameter models, as shown in the screen **1520**.

In this case, the mobile terminal **100** does not receive recommended fitting parameter models, and rather receives information about a recommended fitting parameter model. Unlike the automatic fitting mode, in the manual fitting mode, as the user inputs any one of recommended fitting parameter models displayed through the user interface unit **150**, the mobile terminal **100** may receive a fitting parameter model from the server **200**. For example, by selecting "application" with respect to one of the recommended fitting parameter models, the mobile terminal **100** receive a selected fitting parameter model from the server **200**.

As illustrated in the screen **1520**, the user may be provided with a test sound of a recommended fitting parameter model from the server **200**. In this regard, details are described with reference to FIG. **19**.

When a fitting parameter model is received from the server **200**, the setting unit **130** of the mobile terminal **100** sets the received fitting parameter model into the hearing aid **300** connected to the mobile terminal **100**. In this manner, the mobile terminal **100** may easily set the hearing aid **100** with a desired fitting model.

FIG. **16** is a flowchart illustrating a method of fitting a hearing aid **300** and uploading a fitted fitting parameter model along with location information to a server **200**, in a mobile terminal **100**, according to an exemplary embodiment.

In operation **1610**, the fitting of the hearing aid **300** is performed to be suitable for hearing characteristics of a user at a location by using the mobile terminal **100**. For example, the fitting of the hearing aid **300** may be performed by using a fitting program for fitting a hearing aid and obtaining fitting parameter values of the hearing aid **300** to be suitable for hearing characteristics of the user at the location, which is stored in the mobile terminal **100**. However, one or more exemplary embodiments are not limited thereto, and the server **200** may serve a fitting program for fitting a hearing aid and obtaining fitting parameter values of the hearing aid **300**.

The method of fitting the hearing aid **300** may be a method of fitting the hearing aid **300** by using a hearing threshold for each frequency band. However, one or more exemplary embodiments are not limited thereto, and it will be understood by one of ordinary skill in the art that the fitting of the hearing aid **300** may be performed by using one of various methods.

In operation **1620**, fitting parameter values of the hearing aid **300** are set according to the fitting of the hearing aid **300**, which is performed in operation **1610**. Although in the current embodiment, operation **1610** and operation **1620** are sequentially performed, operation of setting fitting parameter values of the hearing aid **300** may be performed in parallel with the fitting of the hearing aid **300**.

In operation **1630**, the hearing aid **300** transmits a fitting parameter model of the fitting parameter values set into the hearing aid **300** to the mobile terminal **100**. The fitting parameter model denotes fitting parameter values of the hearing aid **300**, which are fitted to be suitable for hearing characteristics of a user of the hearing aid **300** and characteristics of the location at which the hearing aid **300** was fitted.

In operation **1640**, the mobile terminal **100** receives the fitting parameter model transmitted from the hearing aid **300**.

In operation **1650**, the mobile terminal **100** acquires location information about the location, at which the hearing aid **300** was fitted, by using a positioning system.

In operation **1660**, the mobile terminal **100** uploads the hearing characteristics of the user, location information about a location at which the hearing aid **300** was fitted, and

the fitting parameter model to the server **200**. In this case, the mobile terminal **100** may upload the hearing characteristics of the user along with other information to the server **200**. However, the mobile terminal **100** may not directly upload the hearing characteristics of the user to the server **200**, but may upload the hearing characteristics to the server **200** by using another server (for example, the second server **210** of FIG. **6**C) storing the hearing characteristics of the user, as explained with reference to FIG. **6**C.

In operation **1670**, the server **200** stores the fitting parameter model along with the hearing characteristics based on the location information. For example, the server **200** may map fitting parameter models of the hearing aid **300** to each location and may store the mapped fitting parameter models along with the hearing characteristics into a database.

Accordingly, as the server receives fitting parameter models from the mobile terminal **100** of the user and stores the received fitting parameter models along with the location information, the server **200** may provide a fitting parameter model mapped to each location to the mobile terminal **100**.

FIG. **17** is a flowchart illustrating a method of fitting a hearing aid **300** and uploading a fitted fitting parameter model along with location information to a server **200**, in a mobile terminal **100**, according to another exemplary embodiment. Operations **1710** through **1750** illustrated in FIG. **17** are similar to operations **1610** through **1650** illustrated in FIG. **16**, and thus, descriptions thereof are not repeated.

In operation **1710**, the fitting of the hearing aid **300** is performed to be suitable for hearing characteristics of a user at a location by using the mobile terminal **100**.

In operation **1720**, fitting parameter values of the hearing aid **300** are set according to the fitting of the hearing aid **300**, which is performed in operation **1710**.

In operation **1730**, the hearing aid **300** transmits a fitting parameter model of the fitting parameter values set into the hearing aid **300** to the mobile terminal **100**.

In operation **1740**, the mobile terminal **100** receives the fitting parameter model transmitted from the hearing aid **300**.

In operation **1750**, the mobile terminal **100** acquires location information about a location, at which the hearing aid **300** was fitted, by using a positioning system.

In operation **1760**, the mobile terminal **100** acquires situation information of the user by using the situation information acquisition unit **170** when fitting the hearing aid **300**. The situation information may indicate information about the surroundings, occasion, time, and situation of the user, which may be determined based on a sound or scene around the user when fitting the hearing aid **300**. The situation information may be acquired through the microphone (not shown) of the hearing aid **300** and the microphone **172** or the camera **117** of the mobile terminal **100**.

In operation **1770**, the mobile terminal **100** uploads the hearing characteristics of the user, the location information about a location at which the hearing aid **300** was fitted, the situation information about the situation of the user when fitting the hearing aid **300**, and the fitting parameter model to the server **200**. In this case, the mobile terminal **100** may upload the hearing characteristics of the user along with other information to the server **200**. However, the mobile terminal **100** may not directly upload the hearing characteristics of the user to the server **200**, but may upload the hearing characteristics to the server **200** by using another server (for example, the second server **210** of FIG. **6**C) storing the hearing characteristics of the user, as explained with reference to FIG. **6**C.

In operation **1780**, the server **200** stores the fitting parameter model along with the hearing characteristics and the situation information based on the location information. For example, the server **200** may map fitting parameter models of the hearing aid **300** to each location and may store the mapped fitting parameter models along with the hearing characteristics and the situation information into a database.

In this manner, as the server **200** provides a fitting parameter model mapped to each location along with the situation information to the mobile terminal **100**, the user may select a fitting parameter model more suitable for situation of the user.

FIG. **18** is a flowchart illustrating a method of setting a recommended fitting parameter model provided from the server **200** into a hearing aid **300**, in a mobile terminal **100**, according to an exemplary embodiment.

In operation **1811** the mobile terminal **100** acquires location information of a user by using the positioning system **110**.

In operation **1812**, the mobile terminal **100** transmits the location information of the user to the server **200** through the communication interface unit **120**.

In operation **1813**, the server **200** searches for a recommended fitting parameter model, based on the location information and hearing characteristics of the user. For example, the server **200** searches for fitting parameter models corresponding to the location information in database in which fitting parameter models mapped to each location are stored, and finds fitting parameter models corresponding to the hearing characteristics from among the searched fitting parameter models. As a result of the search of the server **200**, at least one fitting parameter model corresponding to the location information and the hearing characteristics of the user becomes a recommended fitting parameter model.

In operation **1814**, the server **200** transmits information about a recommended fitting parameter model searched for in operation **1813** to the mobile terminal **100**. The information about the recommended fitting parameter model may be a message indicating that there is at least one recommended fitting parameter model corresponding to location information of a user and hearing characteristics of the user.

In operation **1815**, the mobile terminal **100** displays the received information about the recommended fitting parameter model through the user interface unit **150**. For example, the mobile terminal **100** may receive information about three recommended fitting parameter models from the server **200**, and may display numbers indicating the three recommended fitting parameter models on a screen.

In operation **1816**, the mobile terminal **100** receives a selection of the user for any one of recommended fitting parameter models displayed through the user interface unit **150**. In the above example in which numbers indicating the three recommended fitting parameter models are displayed on a screen, the user may select any one of the numbers indicating the three fitting parameter models displayed on the screen, and the selection of the user may be input to the mobile terminal **100** through the user interface unit **150**.

In operation **1817**, the mobile terminal **100** requests the server **200** to transmit a fitting parameter model selected by the user.

In operation **1818**, the server **200** transmits a corresponding fitting parameter model to the mobile terminal **100** in response to the request of the mobile terminal **100**. In this manner, in a manual fitting mode, the mobile terminal **100** does not directly receive a fitting parameter model searched for in the server **200**. Instead, the mobile terminal **100** first receives information about a recommended fitting param-

eter, and then receives only a fitting parameter model, which the user desires to set, from the server **200**.

For example, if the mobile terminal **100** receives information about three recommended fitting parameter models from the server **200**, the mobile terminal **100** may receive only a fitting parameter model selected by the user from among the three recommended fitting parameter models.

In operation **1819**, after receiving the fitting parameter model selected by the user, the mobile terminal **100** sets the received fitting parameter model into the hearing aid **300** connected to the mobile terminal **100**.

In operation **1820**, the hearing aid **300** operates according to the set fitting parameter model.

In the manual fitting model in which an informing on mode is set, a recommended fitting parameter model provided from the server **200** according to operations described above may be set into the hearing aid **300**.

FIG. **19** is a flowchart illustrating a method of a providing a test sound of a fitting parameter model from a server **200** to a mobile terminal **100**, according to an exemplary embodiment. Operations **1911** through **1915** illustrated in FIG. **19** are similar to operations **1811** through **1815** illustrated in FIG. **18**, and thus, descriptions thereof are not repeated.

In operation **1911** the mobile terminal **100** acquires location information of a user by using the positioning system **110**.

In operation **1912**, the mobile terminal **100** transmits the location information of the user to the server **200** through the communication interface unit **120**.

In operation **1913**, the server **200** searches for a recommended fitting parameter model, based on the location information and hearing characteristics of the user.

In operation **1914**, the server **200** transmits information about a recommended fitting parameter model searched in operation **1913** to the mobile terminal **100**.

In operation **1915**, the mobile terminal **100** displays the received information about the recommended fitting parameter model through the user interface unit **150**.

In operation **1916**, the mobile terminal **100** receives a request for a test sound of a fitting parameter model from the user through the user interface unit **150**. Because in the manual fitting mode, the mobile terminal **100** may receive only a fitting parameter model, which the user desires to set, from the server **200** after first receiving information about a recommended fitting parameter searched in the server **200**, the user may determine whether to receive a recommended fitting parameter model from the server **200** after hearing a test sound of the recommended fitting parameter model selected by the user.

For example, the mobile terminal **100** may receive information about three recommended fitting parameter models and may display the information about the three recommended fitting parameter models on a screen, and the user may select one of the three recommended fitting parameter models displayed on the screen and may request pre-listening of a test sound of the selected fitting parameter model. The user's request for pre-listening of the test sound of the fitting parameter model selected by the user may be input to the mobile terminal **100** through the user interface unit **150**.

In operation **1917**, the mobile terminal **100** accesses the server **200**.

In operation **1918**, the mobile terminal **100** requests the server **200** of a test sound of the fitting parameter model selected by the user. The server **200** may provide a test sound of a fitting parameter model to the mobile terminal **100** through an application program included in the server **200**.

In operation **1919**, the server **200** searches for a test sound of a fitting parameter model. For example, the server **200** may store test sounds of various fitting parameter models, and may search for any one of test sounds stored in a memory (not shown) of the server **200** in response to a request of the mobile terminal **200**.

In operation **1920**, the server **200** provides a test sound of a fitting parameter model to the mobile terminal **100**. For example, the server **200** may provide a test sound of a fitting parameter model to the mobile terminal **100** by executing an application program for providing a test sound of a fitting parameter model.

In operation **1921**, the mobile terminal **100** outputs the test sound provided from the server **200**. For example, the mobile terminal **100** may receive a test sound obtained by executing the application program of the server **200**, and may output the received test sound through a speaker of the mobile terminal **100** or an earphone.

In this manner, the mobile terminal **100** may improve user convenience by providing a test sound of a fitting parameter model along with the fitting parameter model by using the server **200**.

FIG. **20** is a flowchart illustrating a method of providing the evaluation of user satisfaction with a fitting parameter model, in a server **200**, according to an exemplary embodiment.

In operation **2010**, the mobile terminal **100** receives the evaluation of user satisfaction with a fitting parameter model, which is input through the user interface unit **150**. The evaluation of user satisfaction indicates the level of user satisfaction with a fitting parameter model after the user applies the fitting parameter model, which is received from the server **200** by using methods described with reference to FIGS. **1** through **19**, to the hearing aid **300** and then uses the hearing aid **300**.

The evaluation of user satisfaction may be performed by a way of rating a grade with respect to the level of satisfaction with a fitting parameter model. However, one or more exemplary embodiments are not limited thereto, and the evaluation of user satisfaction may be performed by a way of describing user comments with respect to the level of satisfaction with a fitting parameter model.

In operation **2020**, the mobile terminal **100** transmits the evaluation of user satisfaction with the fitting parameter model to the server **200** through the communication interface unit **120**.

In operation **2030**, the server **200** stores the evaluation of user satisfaction with the fitting parameter model, which is received from the mobile terminal **100**. For example, the server **200** may store the evaluation of user satisfaction with each fitting parameter model in a form of database.

In operation **2040**, the server **200** may provide a recommended fitting parameter model along with the evaluation of user satisfaction with information about the recommended fitting parameter model when providing information about the recommended fitting parameter model to the mobile terminal **100**. The evaluation of user satisfaction with the recommended fitting parameter model may be included in information about the recommended fitting parameter model. For example, when the mobile terminal **100** displays information about a recommended fitting parameter model through the user interface unit **150**, the mobile terminal **100** may display the evaluation of user satisfaction with the recommended fitting parameter model as well as the recommended fitting parameter model so that a user may refer to the evaluation of user satisfaction in selecting the recommended fitting parameter model.

Accordingly, users may share the evaluation of satisfaction with fitting parameter models that are provided from the server **200**, thereby improving the reliability of the fitting parameter models.

Other embodiments of the present invention can also be implemented through computer-readable code/instructions in/on a medium, e.g., a computer-readable medium, to control at least one processing element to implement any above-described embodiment. The medium can correspond to any medium/media permitting the storage and/or transmission of the computer-readable code.

The computer-readable code can be recorded/transferred on a medium in a variety of ways, with examples of the medium including recording media, such as magnetic storage media (e.g., ROM, floppy disks, hard disks, etc.) and optical recording media (e.g., CD-ROMs or DVDs), and transmission media such as Internet transmission media. Thus, the medium may be such a defined and measurable structure including or carrying a signal or information, such as a device carrying a bit stream according to one or more embodiments of the present invention. The media may also be a distributed network, so that the computer-readable code is stored/transferred and executed in a distributed fashion. Furthermore, the processing element could include a processor or a computer processor, and processing elements may be distributed and/or included in a single device.

It should be understood that the exemplary embodiments described therein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each embodiment should typically be considered as available for other similar features or aspects in other embodiments.

What is claimed is:

1. A method of a mobile terminal for fitting a hearing aid connected to the mobile terminal, the method comprising:

acquiring location information comprising a location of the mobile terminal and movement information of the mobile terminal by using a positioning system;

acquiring situation information by using at least one of a camera disposed on the mobile terminal, a user input, and a microphone of the mobile terminal;

transmitting the location information and the situation information to a server;

determining to receive a fitting parameter model based on the movement information and the situation information;

receiving, from the server, the fitting parameter model corresponding to the situation information and the location information of the mobile terminal, and hearing characteristics of a user from among a plurality of fitting parameter models of the hearing aid; and

controlling the hearing aid according to the fitting parameter model,

wherein the situation information indicates at least one of surroundings, an occasion, and a situation of the user, which are determined based on at least one of an input, a sound, and a scene.

2. The method of claim **1**, wherein the receiving comprises:

receiving, from the server, the fitting parameter model corresponding to the hearing characteristics of the user from among the plurality of fitting parameter models associated with the hearing aid that are mapped according to information about the location.

3. The method of claim **2**, wherein the server stores the plurality of fitting parameter models associated with the hearing aid that are mapped to each location in association with the hearing characteristics.

4. The method of claim **1**, further comprising:

acquiring the movement information of the mobile terminal by using at least one of an acceleration sensor and a geomagnetic sensor of the mobile terminal; and

determining to receive the fitting parameter model based on the acquired movement information.

5. The method of claim **4**, wherein it is determined to receive the fitting parameter model if a moving distance of the mobile terminal is greater than a predetermined distance based on the movement information.

6. The method of claim **4**, it is determined to receive the fitting parameter model if the mobile terminal moves at a speed, which is less than a predetermined speed, based on the movement information.

7. The method of claim **1**, further comprising:

receiving, from the server, a warning message that informs the user of an error zone where an abnormality of the hearing aid has occurred when the location information of the mobile terminal corresponds to the error zone registered in the server.

8. The method of claim **7**, wherein the server stores records about the occurrence of the abnormality of the hearing aid with respect to each location, and registers error zones based on the records.

9. The method of claim **1**, further comprising:

acquiring the situation information of the user by further using a microphone disposed on the mobile terminal; and

transmitting the acquired situation information to the server,

wherein the situation information indicates at least one of surroundings, occasion, and situation of the user, which are determined based on at least one of a sound or scene, and

wherein the receiving of the fitting parameter model comprises receiving the fitting parameter model determined based on the location information, the hearing characteristics of the user, and the situation information.

10. The method of claim **1**, further comprising:

generating a custom fitting parameter model for the hearing aid that is fitted by using a fitting program for fitting the hearing aid and obtaining fitting parameter values of the hearing aid, the fitting program being stored in at least one of the mobile terminal and the server;

acquiring fitting location information about a fitting location, at which the hearing aid is fitted, by the positioning system; and

uploading the fitting location information and the custom fitted fitting parameter model from the mobile terminal to the server.

11. The method of claim **10**, further comprising:

acquiring the situation information during the fitting of the hearing aid by further using a microphone disposed on the mobile terminal; and

uploading the situation information from the mobile terminal to the server,

wherein the situation information indicates at least one of surroundings, occasion, and situation of the user that are determined based on at least one of a sound and scene.

12. The method of claim **1**, wherein the hearing characteristics of the user are transmitted to the server from at least one of the mobile terminal and another server.

13. The method of claim 1, further comprising:
transmitting authentication information of the user to a second server,
wherein the second server transmits the hearing characteristics of the user to the server based on the authentication information of the user, and
wherein the server determines the fitting parameter model based on the location information and the hearing characteristics of the user from the second server.

14. The method of claim 1, wherein the hearing aid is connected to the mobile terminal by using a wireless local area network (LAN) technology.

15. A method of fitting a hearing aid connected to a mobile terminal, the method comprising:
acquiring information comprising a location of the mobile terminal and movement information of the mobile terminal by using a positioning system;
acquiring situation information by using at least one of a camera disposed on the mobile terminal and a microphone disposed on the mobile terminal;
transmitting the location information and the situation information to a server;
determining to receive a fitting parameter model based on the movement information and the situation information;
receiving, from the server, information about at least one recommended fitting parameter model corresponding to the situation information and the location information of the mobile terminal, and hearing characteristics of a user of the hearing aid;
displaying the information about the at least one recommended fitting parameter model;
receiving the fitting parameter model selected by the user from among the at least one recommended fitting parameter model; and
controlling the hearing aid according to the received fitting parameter model,
wherein the situation information indicates at least one of surroundings, an occasion, and a situation of the user, which are determined based on at least one of a sound or a scene.

16. The method of claim 15, wherein the recommended fitting parameter model corresponds to at least one fitting parameter model corresponding to the hearing characteristics of the user from among a plurality of fitting parameter models mapped to the location.

17. The method of claim 16, wherein the server stores fitting parameter models of the hearing aid, that are mapped to each location, in association with the hearing characteristics.

18. The method of claim 15, wherein the information about the recommended fitting parameter model comprises:
a message indicating that there is at least one recommended fitting parameter model determined based on the location information of the mobile terminal and the hearing characteristics of the user.

19. The method of claim 15, wherein the server is a cloud server, and the method further comprising outputting, from the server, a test sound to the hearing aid to which the recommended fitting parameter model is applied, by connecting the mobile terminal to the cloud server.

20. The method of claim 15, further comprising:
receiving an evaluation of satisfaction with the received fitting parameter model from the user; and
transmitting the received evaluation of satisfaction to the server,
wherein the information about the recommended fitting parameter model comprises the evaluation of satisfaction.

21. The method of claim 20, wherein the server stores a fitting parameter model for each location in association with the corresponding evaluation of satisfaction.

22. The method of claim 15, wherein the hearing aid is connected to the mobile terminal by using a wireless local area network (LAN) technology.

23. The method of claim 15, further comprising:
receiving, from the server, a warning message that informs the user of an error zone where an abnormality of the hearing aid has occurred when the location information of the user corresponds to the error zone registered on the server.

24. The method of claim 15, further comprising:
generating a custom fitting parameter model for the hearing aid that is fitted by using a fitting program for fitting the hearing aid and obtaining fitting parameter values of the hearing aid, the fitting program being stored in at least one of the mobile terminal and the server;
acquiring fitting location information about a fitting location, at which the hearing aid is fitted, by a positioning system; and
uploading the fitting location information and the custom fitted fitting parameter model from the mobile terminal to the server.

25. A non-transitory computer-readable medium having recorded thereon a computer program that is executable by a computer to perform the method of claim 1.

26. A mobile terminal connected to a hearing aid, the mobile terminal comprising:
a positioning system configured to acquire information comprising a location of the mobile terminal and movement information of the mobile terminal;
a situation information acquisition unit configured to acquire situation information from the user, wherein the situation information indicates surroundings of the user, which are determined based on a scene,
a processor configured to determine whether to receive a fitting parameter model if a moving distance of the mobile terminal is greater than a predetermined distance based on the movement information;
a communication interface configured to transmit the situation information and the location information of the mobile terminal to a server, and receive, from the server, the fitting parameter model corresponding to the situation information and the location information of the mobile terminal and hearing characteristics of a user from among fitting parameter models of the hearing aid; and
a control unit configured to control the hearing aid according to the fitting parameter model,
wherein the situation information further indicates at least one of an occasion, and a situation of the user, which are determined based on a sound.

27. The mobile terminal of claim 26, further comprising:
a user interface unit configured to receive a fitting mode input selection from the user, selecting between a manual fitting mode and an automatic fitting mode.

28. The mobile terminal of claim 26,
further comprising a processor configured to determine to receive the fitting parameter model from the server when the received fitting mode selected is an automatic fitting mode,

wherein the communication interface unit receives the fitting parameter model, and

wherein the setting unit sets the received fitting parameter model into the hearing aid in response to the reception of the fitting parameter model.

29. The mobile terminal of claim **27**, further comprising a processor configured to determine to receive a message, indicating that there is at least one recommended fitting parameter model determined based on the location information of the mobile terminal and the hearing characteristics of the user, in advance to receive the fitting parameter model from the server, wherein the communication interface unit receives the message from the server when the received fitting mode is the manual mode.

30. The mobile terminal of claim **27**, further comprising:

a memory configured to store at least one fitting parameter model,

wherein the user interface unit displays the at least one fitting parameter model stored in the memory and receives selection by the user of any one fitting parameter model from among the displayed at least one fitting parameter model when the received fitting mode is in the manual mode, and

wherein the setting unit sets the received fitting parameter model into the hearing aid.

31. The mobile terminal of claim **26**, further comprising

a user interface unit configured to receive an informing mode which is input from the user between an informing "on" mode for receiving at least one recommended fitting parameter model and an informing "off" mode; and

a processor configured to determine whether to receive information about the recommended fitting parameter model according the received informing mode,

wherein, when the received informing mode is the informing "on" mode, the processor determines to receive information about at least one recommended fitting parameter model in advance to receive the fitting parameter model from the server, the communication interface unit receives the information about the at least one recommended fitting parameter model from the server, the user interface unit displays the information about the at least one recommended fitting parameter model and receives any one fitting parameter model selected by the user from among the at least one recommended fitting parameter model.

32. The mobile terminal of claim **31**, wherein the user interface unit receives an evaluation of satisfaction with the received recommended fitting parameter model from the user, and the communication interface unit transmits the received evaluation of satisfaction to the server, wherein the information about the recommended fitting parameter model comprises the evaluation of satisfaction.

33. The mobile terminal of claim **26**, further comprising:

a movement information acquisition unit configured to acquire movement information of the mobile terminal; and

a processor configured to determine whether to receive the fitting parameter model based on the acquired movement information.

34. The mobile terminal of claim **26**, wherein the communication interface unit receives, from the server, a warning message, that informs the user of an error zone where an abnormality of the hearing aid has occurred when the location information of the mobile terminal corresponds to the error zone registered on the server.

35. The mobile terminal of claim **26**, further comprising:

a fitting unit configured to acquire a fitting parameter model of the hearing aid of the user, that is fitted by using a fitting program for fitting the hearing aid and obtaining a fitting parameter of the hearing aid, the fitting program being stored in the mobile terminal or the server,

wherein the positioning system acquires location information about a location at which the hearing aid is fitted, and the communication interface unit uploads the location information and the fitted fitting parameter model from the mobile terminal to the server.

36. A non-transitory computer-readable medium having recorded thereon a computer program that is executable by a computer to perform the method of claim **15**.

37. A method executed on a user equipment that is communicatively connected to a hearing aid, the method comprising: acquiring location information of the user equipment by using a positioning system; acquiring situation information by using at least one of a camera disposed on the user equipment, a user input, and a microphone of the user equipment; determining a fitting parameter model for the hearing aid based on the location information and the movement information and the situation information; receiving, from a server, the fitting parameter model corresponding to the situation information and the location information of the user equipment, and hearing characteristics of a user from among a plurality of fitting parameter models of the hearing aid; and controlling the hearing aid according to the fitting parameter model, wherein the situation information indicates at least one of surroundings, an occasion, and a situation of the user, which are determined based on at least one of an input, a sound, and a scene.

38. The method of claim **37**, wherein controlling the hearing aid comprises:

transmitting, from the user equipment, at least one of a signal, a fitting parameter model value, and the fitting parameter model to the hearing aid.

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